



Cairo Air Improvement Project  
Overall Management Component

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**CAIP Sustainability Report**

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Chemonics International, Inc.  
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## Introduction

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The Cairo Air Improvement Project will eventually come to an end, but the important interventions being initiated must continue on. Although sustainability has always been a factor in planning and executing CAIP activities, the development of a CAIP Sustainability Plan was the start of a more systematic approach to incorporating elements of sustainability into CAIP's project management systems.

The CAIP Sustainability Plan was developed in April and May 1999 by a team of experts led by then short-term consultant Gilbert Richard (CAIP COP as of June 1999), with substantial involvement by a second short-term consultant, Jeannie Sowers. Members of the CAIP Planning, Transition Assurance, and technical component teams also contributed to the plan development.

Working with CAIP staff members and stakeholders, the Sustainability Team developed sustainability plans for each of CAIP's four technical components. The plan development process consisted of assessing the current state of project priorities, analyzing anticipated implementation barriers, and identifying solutions to minimize them.

The sustainability plans for each of CAIP's four technical components are contained in this document. In addition to a narrative discussion of the issues identified and recommended approaches to addressing them, at the end of each component section is a table summarizing the narrative discussion.

The purpose of this sustainability exercise was to create a "road map" for sustainability of CAIP activities. This report is meant to serve as a catalyst for discussion of the issues impacting long-term viability of CAIP programs. The issues and recommendations were timely and pertinent at the time of drafting (May 1999). Some issues have subsequently been addressed; some may become moot as implementation takes on new directions. Over time other issues will emerge. It is anticipated that recommendations from the sustainability plan drafts will be discussed in the technical components' working group meetings, and that recommendations will then be incorporated into the PERT charts as they are adopted. This will then serve as CAIP's "road map" to sustainability, identifying steps, resources requirements, decision-making points, etc. to ensure the successful transfer of appropriate project initiatives to local institutions.

## I.

### **Vehicle Emission Testing (VET)**

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#### **A. Introduction**

The goal of Cairo Air Improvement Project's (CAIP) Vehicle Emission Testing (VET) component, as described in the United States Agency for International Development (USAID)–Chemonics International contract is fuel efficiency improvement and exhaust emissions reduction of gasoline and diesel-fueled vehicles through a vehicle emission testing, tune up and certification program.

Since the initiation of the project, CAIP developed program requirements for a Cairo VET program and began implementation of selected features. The major steps undertaken include:

- ♦ Designed specifications for a centralized, test-only network and drafted a private sector network tender.
- ♦ Facilitated the signing of a Memorandum of Understanding (MOU) between the Ministry of the Interior (MOI) and the Egyptian Environmental Affairs Agency (EEAA) on timing of on-road testing, the addition of three model centers in addition to the technical center and the MOI decree announcing enforcement of vehicle emission standards.
- ♦ Implemented an on-road-testing program at the request of the Minister of Environment, which as of 3 May 1999 had tested 11,000 cars in 3 months.
- ♦ Distributed analyzers and trained staff at 29 gas stations in low-emission tune-up skills.
- ♦ Negotiated site selection for the VET Technical Center, two of the three model centers, and initiated construction at one site. The third site was negotiated but is now being disputed.
- ♦ Proposed emissions standards for all new vehicles sold in or imported to Egypt. Proposed new and in-use motorcycle emissions standards.

In undertaking these activities, several outstanding issues emerged that are important in making the VET program sustainable. These are explored in some detail in the following sections.

These issues are broadly organized by Pert Chart Tasks. Most of the transition assurance issues fall under the scope of Policy and Institutional Support, and Vet Network, although many points will have ramifications for the other tasks. Accordingly, they are presented in order of importance for sustainability, rather than by Pert Chart Task numbers.

## **B. Institutional Elements for VET Network**

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### **Network Design**

CAIP designed specifications for a VET technical center for EEAA and a centralized, test-only network to be contracted to a private sector company. The network was to be overseen by EEAA. Initially, no substantive role was envisioned for the Traffic Departments in the network itself. However, since authority for enforcement was vested with the Ministry of Interior, the Traffic Departments became a necessary counterpart.

The MOU signed between EEAA and MOI made some important modifications to EEAA and Traffic Department roles and responsibilities. The MOU specified that the VET test centers will include space and equipment for the Traffic Department to conduct safety inspections. This changes the network design substantively, because the cost of safety equipment must be included and because the Traffic Departments will supply their own staff to conduct safety inspections at the test stations. Implications are explored under Sections B, C, and E.

### **EEAA Oversight Role in VET Network (Technical Center)**

CAIP is responsible for developing operating procedures for the VET network, including helping to clarify institutional roles for the Traffic Departments, private sector contractor, and the EEAA. Ideally, these roles would be resolved in practice through the operation of the Model Centers, but current timelines for the private sector tender preclude including the contractor in this pilot phase. (See recommendations that follow for including the private sector earlier in the VET timelines under Section B, Vet Tender.) While the Technical Center is to be operated by EEAA, similar clarity does not exist for the role of EEAA in either the Model Centers or the eventual private sector stations.

Contractually, CAIP must provide technical assistance in developing and training the EEAA VET Section in the necessary oversight functions for the network. The MOU between the MOI and EEAA covered initial roles and responsibilities for VET, and

CAIP has presented EEAA with several proposals detailing potential staffing needs for the VET Technical Center.

Oversight of VET programs typically include supervision of the private sector contractor's performance, including auditing and inspection of stations, as well as review of the VET programs as a whole, making recommendations for changing standards and testing technologies as needed. EEAA, which is understaffed, is also hampered by limited authority. The VET Working Group should consider EEAA's circumstances in drafting the oversight role for EEAA.

### **Limited EEAA Authority to Oversee VET Programs**

EEAA may not yet have the legal tools to hold a non-performing private sector contractor or governorate to account. There are two primary reasons for this: first, for most activities (with the exception of overseeing the protectorates), the EEAA does not have executive authority, only a coordinating function with other ministries. Accordingly, when the draft tender document was prepared, it was claimed that EEAA does not have the authority to enter into the tender agreement with a private sector contractor.

If this is the case, the VET Working Group should decide the following issues:

- ♦ What entity will enter into the tender contract?
- ♦ How will EEAA be included?
- ♦ What substantive sanctions or inducements can be used to back up this oversight role?

In the United States (US), the United States Environmental Protection Agency's (USEPA) "stick" for recalcitrant states and local governments that do not implement vehicle emission testing programs as required by law was to withhold federal highway funds. EEAA has no such incentive, and citizens have little recourse to effective suits to make the governorates or EEAA implement mandated programs. CAIP's Transition Assurance (TA) unit recommends considering supplementing these centralized regulatory/oversight efforts with supplementary economic incentives as described in Section G, below.

### **Limited Capacity of EEAA**

The agency is understaffed and under-funded. As a result, it has difficulty recruiting and keeping talented staff except when supplemental funding (usually from donor agencies and projects) is available. This suggests either keeping administrative burdens on the agency to a minimum, or explicitly providing for capacity building during the timeframe of the project. This task is critical because in its absence, the central EEAA organization may model its oversight functions after current inspection and compliance operations, which depend on high-level personal visits, little formal follow-up, inadequate auditing procedures, and excessive centralization. The VET Working Group should:



- ♦ Clarify which functions must be performed by EEAA and whether some oversight functions should be handed over to the Traffic Departments or the governorates.
- ♦ Develop specific capacity building plans that address the agency's needs. This task may be broader than the operating procedures for the Technical Center as currently planned.

A likely institutional arrangement would be a VET Section within the Air Quality Section of the central EEAA. Some consideration should be given to the role of the EEAA regional branch offices in overseeing other VET programs, such as the one in Alexandria Governorate. Proposed administrative roles can be checked against recommendations made by the Organizational Support Project (OSP) on proposed roles and responsibilities for the regional branch offices of EEAA, governorate environmental monitoring units, and the central EEAA.

Based on current network design, EEAA oversight activities will include:

- ♦ Evaluating network activities through scheduled reviews of reports submitted by the private sector contractor.
- ♦ Making regulatory recommendations using data from the network, including evaluation of standards.
- ♦ Setting certification procedures for network stations, resolving conflicts and managing a referee procedure, and setting waiver procedures for old and/or grossly polluting cars.

## Network Tender

CAIP is responsible for providing assistance in preparing the private sector tender document for the VET network. Several companies have expressed interest in bidding on the tender. CAIP has drafted a tender document, which needs revision as several relevant parameters have changed. Primary among these is that EEAA may not be authorized to enter into a contract on behalf of the Government of Egypt (GOE).

One of the most salient issues for transition assurance is that the private sector needs sufficient enforcement guarantees to undertake network operations. This does not necessarily require that work on the tender be held up until the MOI enforcement decree is issued.

## Recommendations

- ♦ A draft tender could be circulated as soon as possible through an open invitation to private sector counterparts, to get their input for the final tender and help build momentum to push government entities to make needed policy decisions more quickly.
- ♦ Early release of Phased Operating Tender (discussed below).

## Two-phase Tender

The tender is not scheduled to be issued until after the MOI issues a decree for blanket enforcement of Law No. 4 (the environmental law) vehicle emission standards. In order to simulate actual network operation in the Model Centers and to offer MOI an incentive to issue the enforcement decree in a timely fashion, a private sector contractor could be sought earlier. The TA team recommends investigating a two-phase tender. Phase One would contract operation of Model Centers to a private company, and Phase Two would award the network to the same contractor if certain performance criteria were met.

From the private sector perspective, Phase One offers an opportunity to gain operating experience and clarify procedural issues with the Traffic Departments and EEAA with virtually no investment, as buildings, equipment, and training are provided by CAIP. From EEAA's perspective, this relieves it of the need to staff the Technical and Model Centers in the time between completion of those centers and completion of the privately-run network.

This approach could have the following advantages:

- ♦ Model Centers would be true project simulations for working out roles and responsibilities, adjusting these as necessary. This might be attractive to private sector contractors before they are asked to commit to more substantive investments.
- ♦ It would eliminate the need for EEAA to run the Model Centers directly, which is not part of an oversight role. Hiring sufficient staff for both Technical and Model Centers through EEAA or CAIP may be difficult, and would require retraining of private sector contractor staff when the network was turned over to private sector management.
- ♦ Criteria for tender selection could emphasize operational skills in running a VET network, instead of being oriented to construction and land acquisition activities. This could be important in selecting a qualified private sector company.

The primary obstacle would be contingency planning for the contractor failing to meet performance criteria, but a similar problem exists with the tender as currently planned.

## Financial Feasibility and Fee Structure for the VET Program

The CAIP contract calls for conducting financial feasibility studies to provide input on proposed testing fees. The first financial feasibility study found that the single most determining factor of private sector profitability was number of cars passing through the testing stations. The modified CAIP contract states that fees will be equalized for all sites and a portion of the fees will go toward administrative oversight costs, but this has not been defined. CAIP proposed two fee collection mechanisms: one done in a way similar to payment of registration fees through the post office; the other collection of fees at a kiosk at the testing site.

## Recommendations

Before fee structure or collection mechanism is set, oversight between EEAA, the governorates, and the Traffic Department should be clarified, as this may add a new party to the fee structure/revenue distribution and to discussions of collection mechanism.

The financial feasibility study should be redone using new parameters. The following elements should be included as variables and used for a “what-if” sensitivity analysis:

- ♦ Vehicle type: car, motorcycle, taxi, microbus, light truck, heavy truck, and bus
- ♦ Frequency of inspection by vehicle type: for private cars, motorcycles, and agricultural trucks, this is every 3 years; for taxis, minibuses, and trucks, every year
- ♦ Effect of safety inspections on number of vehicles that can be moved through the VET stations in a period of time
- ♦ Effect of having fewer VET stations with larger capacities
- ♦ Effect of individual failure rates for each vehicle type
- ♦ Include a cost ranging from £E0 to full fee to re-test each individual vehicle type
- ♦ Inspection fee per vehicle type
- ♦ Effect of number of total staff/lane on station’s profitability
- ♦ Effect of costs for safety inspections
- ♦ Effects of targeted vehicle testing for taxis or minibuses, etc.

The cost of safety inspections must be included if the private sector contractor is going to provide safety inspection equipment. In addition, the cost of tune-ups should be considered in setting the range of acceptable testing costs.

Targeted vehicle emission testing would reduce the population subject to financial hardship from the cost of testing and tune-up, particularly since public and private sector fleet vehicles would not be paid for by individuals.

## C. Policy and Institutional Support Issues

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Institutional and policy issues related specifically to the VET network design are addressed above. Policy issues here refer to issues of enforcement and standards.

### Enforcement and Compliance

Adequate enforcement mechanisms are necessary to make the VET program a success. In addition to ensuring that the VET program has an impact on vehicle emissions, enforcement is necessary to make the private sector network viable, as feasibility projections rely on a minimum number of vehicles undergoing testing. CAIP’s objective is to help design enforcement for the testing program. USAID–Chemonics International

contract modification No. 3 calls for traffic department enforcement of Law No. 4 through a combination of registration denial and on-road testing.

According to the MOU, the MOI decree for enforcement will be issued after the entire VET network is up and running. At that time, the Traffic Authorities will withhold licenses of non-complying vehicles during on-road testing, conduct safety inspections through two staff members at each VET station, and enforce Laws No. 4 and 66. The Traffic Departments have made clear they will keep the current 3-year vehicle registration cycle.

## **Recommendations**

### **Frequency of Testing**

The implications of a 3-year registration cycle for passenger cars, motorcycles, and agricultural trucks should be clarified. CAIP needs to find out from the MOI the proportion of the fleet re-registering every year, information that MOI has been reluctant to share thus far. For those cars registered every 3 years, vehicle emissions testing will be limited to once every 3 years instead of annually as originally envisioned. Section B suggests including this impact in an updated financial feasibility study.

### **Larger Vehicles**

The inclusion of larger vehicles such as buses and trucks in VET program coverage should be considered. As these vehicles are often diesel-fueled, they emit a disproportionate amount of fine particulate emissions, which is deemed one of the biggest health hazards along with lead under CAIP's mandate. Thus a VET program should not exclude these vehicles. Although the current VET station designs will not handle large trucks or buses, several options could be pursued. For example, large vehicles could be added to on-road and spot enforcement programs.

### **On-road Testing/On-road Enforcement**

Developing on-road or spot enforcement to supplement 3-year registration enforcement should be considered. Project staff have recommended that certificates issued on successful vehicle emission testing—which are required for vehicle registration—be supplemented with a visible windshield sticker. This suggestion should be pursued. Spot inspection procedures in other countries have included on-road checks and checks of parking lots and street-parked cars for windshield stickers. Once the MOI issues the enforcement decree, the existing on-road-testing program could be expanded to include enforcement powers.

An expanded on-road program would have several additional benefits for other project objectives. Fleet performance data, currently collected in a database, could be used by EEAA's VET section to compile "high-emitter profiles" of the most polluting vehicle

types, and to supplement information collected by the VET stations. On-road teams could also perform fleet testing as needed.

The current on-road-testing program designed by CAIP and staffed by EEAA has tested 11,000 between 2 February and 3 May 1999, of which 65.7 percent passed. The program does not have the authority to require tune-ups for the 34 percent of vehicles failing the test. The future of the on-road program is in doubt, as EEAA has not made budget allocations for the upcoming year.

### **Supplementary Economic Incentives**

Three-year registration for the majority of vehicles suggests that greater attention should be given to incorporating economic incentives that can support compliance. These include buy-backs or mandatory retirement of grossly polluting vehicles, subsidized loans for re-powering or retrofitting, and higher registration fees for grossly polluting vehicles. These ideas are expanded in more detail in the concluding section on proposed VET project modifications.

### **Fleet Testing**

Several private and public sector companies have requested that their fleets be tested. For public sector companies, this would mean ministerial protocols be developed between EEAA and, for example, the Ministry of the Public Enterprises to have Cairo's public sector fleets tested at the Model Centers.

### **Vehicle Emissions Standards for New and In-use Vehicles**

CAIP is responsible to help review existing emission standards, propose changes, and coordinate between a variety of ministries to hasten adoption of revised standards through ministerial decrees. Law No. 4 provides standards for new and in-use vehicles that are seriously lax. CAIP, in conjunction with EEAA and the Ministry of Industry, recommended leaving in-use standards as is for the present, and tightening standards for all new vehicles imported and/or sold in Egypt, based on European and American standards. Vehicle models approved under European or USEPA emissions certifications would be certified and sold in Egypt without further certification. Emission control devices can be added at a small incremental cost to new vehicle buyers and demand for new vehicles has historically not been dampened by such costs. The rate of modernization of the Cairo fleet should not decrease.

Few new vehicle assembly and production plants in Egypt use up-to-date emissions control equipment. Since the introduction of unleaded gas, it is now possible to equip cars with catalytic converters, but this is not widely done, despite a Ministry of Industry decree requiring their use.

Draft standards for new and in-use motorcycles were also put forward by CAIP. Motorcycle manufacturers reacted strongly in opposition to imposing vehicle emission standards on their product.

None of the standards have been formally ratified yet by the GOE.

## Recommendations

Developing certification procedures for vehicle imports and local assemblers as well as enforcement mechanisms should be a top priority. Raising the level of vehicle emissions controls added to new vehicles may be the largest contribution to reducing vehicle emissions that CAIP can make, since most of the projected increase in the Cairo fleet will be in newer vehicles.

The VET Work Group could tackle the issue of how to monitor the implementation of new vehicle standards once these are adopted. Therefore, the Work Group should make decisions on new vehicle standards as follows:

- ♦ Timetable for adoption of new standards for cars and for motorcycles.
- ♦ Monitoring mechanism for enforcing new standards.
- ♦ Inclusion of emission control technology on all imported or assembled new vehicles.

## D. Private Sector Low Emission Tune-up and Repair Capacity

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Contractually, CAIP will make provisions for building necessary private sector low emission tune-up (LETU) capacity. The Phase I Tune-up Program initiated summer of 1998 consisted of distributing EEAA-owned gas analyzers to and training staff at self-selected group of gas stations. This introduced the concept of low emission tune-up and emissions testing. A data collection system was created in conjunction with the Tune-up Phase I Program and expanded when the ORT phase began. The gas stations participating in the Phase I Program collect data on the vehicles that are tested, as does EEAA staff conducting the ORT. Data is collected in one database for both. CAIP has undertaken a study to clarify current LETU capacity.

Experience with VET programs in other developing countries suggests that, even where strong enforcement mechanisms exist, motorists may still avoid both testing and re-testing. Therefore, alternative incentives for tune-up should be considered. ECEP pilot project suggested tune-ups were appealing to motorists on grounds of enhanced fuel efficiency. Motorists participating in the Tune-up Phase I also indicated initial eagerness to tune-up their vehicles, though interest on the part of both the service providers and the motorists declined substantially over time, perhaps due to withdrawal of public

awareness materials. Public awareness campaigns about the benefits of low emission tune-ups are critical for success.

Economic incentives provide another avenue to increase the use of low emission tune-ups. Although such economic incentives can be targeted to vehicle owners, it may be more effective to apply such incentives to those who actually repair the vehicles. The question to be asked is, “How can CAIP help garage owners want to provide low emission tune-ups?” The goal is to give mechanics a direct market interest in both expanding capacity to conduct tune-ups and in marketing their services to the public.

## Recommendations

Several potential avenues could be explored:

- ♦ Devise a certification system for participating gas stations, and offer a list of such stations at all VET testing stations. As a further elaboration, Phase 1 tune-up data from gas stations could be used to see how effectively various gas stations perform low emission tune-ups. Garage repair performance results—does the tune-up help the vehicle pass the test?—can be put into “report cards.” These rankings could be passed out to motorists at testing centers to provide a performance incentive to garages.
- ♦ Develop a system that gives direct monetary incentives to garages based on the number of successful low-emission tune-up repairs conducted. This would require gas stations to be both certified with EEAA, and capable of conducting re-tests. As described in A.1, Network Design, re-testing at garages may be necessary if fewer testing centers are provided.

These measures could be undertaken in addition to the following CAIP activities:

- ♦ Expand existing links with gas stations.
- ♦ Expand distribution and training on analyzers and low emission-focused tune-ups.
- ♦ Provide public awareness materials for distribution at cooperating gas stations.
- ♦ Take the cost of a tune-up into consideration when setting the VET testing fee.

## E. Model Centers

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Three model centers are to be constructed and equipped with emissions testing equipment. The initial CAIP scope of work included building only the Technical Center and one model center. The expansion to three Model Centers means a longer period of time until the tender can be issued for network construction.

Land was designated for the Katimiyya Technical Center, although this is now being contested by the Cairo Governorate, and the Architectural and Engineering (A&E) design contract for the Tech Center has been assigned. Land was allocated for the Giza and Qalioubiya (Shoubra el-Kheima) Model Centers. Land for the Cairo model site is

being negotiated with EEAA and the governorate. Construction has begun at Qalioubiya Model Center, and is scheduled for completion by July of 1999; equipment procurement timing currently depends upon USAID–Chemonics International contract modifications.

The MOU signed between EEAA and the MOI made some important modifications to EEAA and Traffic Department roles and responsibilities, some of which were not foreseen at the time the MOU was signed. It specified that the testing centers will include equipment and space for the Traffic Departments to perform safety inspections. This changes the network design substantively, because the Traffic Departments now expect to use their own staff to oversee safety inspections at the testing stations.

The Giza Model Center will be co-located with the existing Traffic Department site, and CAIP is being requested to include Traffic Department office space in the designs for the VET building. This is significant, because by law CAIP–USAID cannot provide support directly to the MOI.

CAIP's experience in siting the Model Center and three Technical Centers has raised several issues. Those relevant to the institutional roles and responsibilities of the Traffic Departments, EEAA, and the governorates are dealt with under Section A, Network Design. Those specifically dealing with number and siting of the testing stations follow.

## **Land Acquisition for VET Sites**

Land acquisition for the VET Centers has proven very difficult and time-consuming, with frequent reversals. For instance, in May the land for the Katimiyya Technical Center, allocated by the Ministry of Housing and New Communities and paid for by CAIP, was contested by the Cairo Governorate. The governorate claims ownership and asserts that the land was already allocated to someone else. As the designs for the VET station have been specifically tailored to this site, losing it will result in significant implementation delays and additional costs.

Multiple claims to land by public agencies are common in Egypt, and a difficulty encountered by every sector. Land costs in central Cairo are high, as land is scarce and central locations are valuable. Plans for the original network, which foresaw up to 25 stations, appear to significantly underestimate the difficulty of acquiring land in Cairo.

## **Recommendations**

TA recommends considering modifying the envisioned network in one of two ways:

### **Mega-centers**

Mega-centers sited on the Ring Road, at the periphery of Greater Cairo should be considered. Expand capacity of each station, reduce number of stations required of the private sector contractor. Fewer mega-centers that perform tests only, located on the



Ring Road, may be more appropriate to Cairo's conditions. While distance to testing stations may be farther, time in transit may be comparable, as there is considerably reduced traffic congestion outside of central Cairo. Adding elements of a hybrid VET system—such as post tune-up re-testing at certified garages—further reduces the inconvenience incurred by vehicle owners.

A VET program combining fewer test-only stations, targeted testing (at least initially), and economic incentives for replacement and repair might be most effective in the Cairo context. This point is expanded in the section on proposed modifications for the VET program, below.

In summary, some of the potential advantages of mega-centers include:

- ♦ Preserving valuable central urban land.
- ♦ Reducing the number of negotiations required with public agencies over land ownership.
- ♦ Cutting dependence on sites from the Traffic Department.
- ♦ Lowering test cost through larger economies of scale.
- ♦ Increasing efficiency for the network program through bypassing traffic congestion and land scarcity issues.

If such a mega-center approach were to be adopted, providing for failed vehicles to be re-testing at certified garages would help to compensate vehicle owners for the longer distance to the testing center.

### **Co-location of VET Sites with Selected Traffic Departments**

This option has already happened with the Giza Model Center. If the Traffic Departments provide sites for VET station, as was done in Alexandria, this would reduce the administrative and cost burden on the private sector contractor(s). This in turn should be reflected in lower test fees, since land is a significant expense.

Primary advantages include:

- ♦ Simplified land acquisition process, if Traffic Departments already have facilities and land they will make available for VET centers.
- ♦ Expedited site expansions for the Traffic Department safety inspections.

The VET Working Group should address several issues if co-location is the option selected. TA recommends the following issues be resolved with the Traffic Departments, governorates, and EEAA before further co-location takes place.

- ♦ Following up on the MOU, reiterated agreement that VET lanes build on Traffic Department land will be operated by a private sector contractor, and that EEAA will have authority over all VET data collection and usage. (Oversight of this contractor must also be resolved, as described in Section A.2, above.)

- ♦ CAIP–USAID cannot provide buildings, equipment, or training to the Traffic Departments as subdivisions of the MOI. Requests for USAID-built office space for the Traffic Departments should be handled carefully.
- ♦ USAID, CAIP, and the VET Working Group should clarify the procedure for considering all such requests on behalf of the Traffic Departments. Various parties have tended to make different promises to counterparts in the past. These can shape the direction of the VET program without sufficient consideration of the consequences by the involved stakeholders.

### **Expand Use of Model Centers**

Expand use of Model Centers in the period before the network is operational. At the moment, according to the MOU, the Model Centers are to offer free tests and be staffed by EEAA–CAIP. This provides neither a pilot phase for the private sector contractor nor uses the centers to capacity. This could be addressed in several ways:

- ♦ Use a two-phase tender for the contractor. Consider charging fees for tests.
- ♦ Phase in enforcement of targeted vehicles as Model Centers come on line.
- ♦ Use Model Centers for public and private fleet testing. Currently several private and public companies have requested on-road testing. Expand on this interest in the network as a whole by incorporating performance rewards to the contractor for marketing and using the sites after mandated hours for the public have been fulfilled.

## **F. Stakeholder Coordination and Public Awareness**

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In any VET design, close cooperation with stakeholders and public information distribution are two key elements. In terms of stakeholder coordination, the most salient step CAIP can undertake is to appoint a sound Working Group with committed stakeholder participants. The VET component also has several staffing vacancies, particularly in institutional and policy issues, which need to be filled sooner rather than later, with a mandate to establish and maintain links with the Traffic Department, the governorates, and EEAA. Furthermore, although the signed MOU laid out draft roles and responsibilities between the Traffic Authority and EEAA, these roles must be filled out and, in some cases, modified, as highlighted above.

Public awareness campaigns can play a key role in convincing people to change their routines. Public acceptance of the VET program could be fostered by considering the ability to pay in setting the fees for VET testing, and by the inclusion of public vehicle fleets in VET testing to enhance public support. Otherwise, owners of private vehicles will rightfully feel they are singled out while the government agencies are let off. As state-owned vehicles are among the most polluting, not addressing the issue of public vehicles could undermine public acceptance.

## G. Proposed Modifications in VET Program Direction

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TA proposes that a VET program combining fewer test-only stations, targeted testing (at least initially), and economic incentives for replacement and repair would be most effective in the Cairo context.

Several reasons underlie this proposal. First, as VET programs in many other countries have shown, government-based enforcement efforts may be incomplete and patchy. Therefore, incentive measures that encourage self-compliance should be considered. Incentives can be targeted for those vehicles not covered by the VET testing design, those vehicles most likely to pollute, or those companies providing tune-up and repair services. The economic analysis done for CAIP in June 1995 said:

Recent analyses have been highly critical of broad-based vehicle control programs, noting that only a very small fraction of vehicles are responsible for a relatively large fraction of pollutant emissions. (Beaton et al, 1995) Programs that target these vehicles (through in-use surveillance monitoring, through remote sensing, or targeted inspection) can be dramatically more cost effective than general programs (e.g., reformulated fuels or comprehensive inspection/maintenance) that address all vehicles.

Second, experience in the US with the implementation of centralized vehicle inspection and maintenance programs, such as planned under CAIP, has been that there are unexpected problems on startup—the network doesn't work quite as planned, the software exhibits bugs, etc. Although these problems are usually resolved quickly, they tend to form an enduring impression on the public. It would be prudent, therefore, to begin the inspection program as soon as possible, on a small scale, with a limited number of vehicles through the Model Centers, and then scale it up, rather than trying to apply it suddenly to all vehicles at the same time.

Third, the most serious health problem in Cairo from air pollution is from fine particulate matter. Traditional VET programs primarily target carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NO<sub>x</sub>) emissions. Among road vehicles, diesel vehicles account for only a small minority of the population, but the great majority of emissions of particulate matter. If one must begin by targeting a limited number of vehicles, these vehicles are the obvious priority targets.

The following suggests modifications in the VET program. These measures could either be phased in before general public compliance or serve as a complement to general compliance efforts. The basic questions that need to be asked are, "What incentive mechanisms can enhance voluntary compliance among selected groups?" and "How can the most polluting vehicle classes and types be targeted for compliance?"

## Targeted VET Program

To achieve more environmental impact per unit of enforcement effort, those vehicles with highest emissions should be targeted first where politically feasible. A targeted program would ideally address both the kinds of vehicles most likely to pollute and those driven most. In Cairo, these groups overlap to a large extent. A vehicle emission reduction program in Cairo should include the following vehicles:

- ♦ 2-stroke motorcycles
- ♦ Micro/minibuses
- ♦ Diesel trucks
- ♦ Diesel transit buses
- ♦ Fleets
- ♦ Taxis
- ♦ Grossly polluting passenger cars.

Some of these vehicles have 1-year registrations, which makes it possible to target these vehicles for inspection before passenger cars, while the network is small. For instance, taxis and minibuses require special permits as well as the regular MOI registration in order to work, and they are subject to annual inspections now. It would be administratively feasible, therefore, to begin by inspecting these vehicles. This would not necessarily require any change in the MOU with the MOI—it might be possible to achieve it through administrative agreements with the governorates alone. The program would involve a manageable number of vehicles, would have little impact on the general public, and would target the vehicles that are responsible for a large share of polluting emissions due to their intensive use.

Once the inspection procedures were proven on these vehicles, they could gradually be expanded to include diesel trucks, two-stroke motorcycles, and passenger cars emitting visible smoke, before finally being extended to the rest of the vehicle fleet. This would allow for an orderly build up of staff, stations, and experience.

The specific policy mix to target these populations would vary. The elements of an alternative approach to vehicle emissions control could include those listed below. These are given for illustrative purposes only as the most effective or politically feasible combinations should be worked out in conjunction with counterparts.

These suggestions for further consideration are not meant to replace the need for a comprehensive vehicle emission testing program or strengthened EEAA presence in vehicle emissions reduction. The primary enforcement mechanisms remain withholding vehicle registration, perhaps combined with on-road enforcement.

## Non-regulatory Incentives

### **Economic Incentives to Re-power, Replace, Retrofit, or Mandatory Retirement of Grossly Polluting Vehicles**

The following incentives are targeted to vehicle owners.

- ♦ Subsidized loans for re-powering, retrofitting or replacing grossly polluting vehicles. GOE programs for CNG conversion provide a possible model. Implementation of these loan programs is through the Social Fund for Development and selected private banks.
- ♦ Pollution surcharge added to the registration fee or other monetary incentive to replace or repair grossly polluting vehicles.
- ♦ Target incentives to owners of grossly polluting vehicles, defined by using information gained from high emitter profiling (described below).

### **Incentives to Generate Tune-up Repair Demand**

These are covered in Section D.

### **High Emitter Profiling and Required Testing/Tune-up of Grossly Polluting Vehicles**

High emission profiling in Cairo could take either of the following approaches:

Vehicles could be targeted through a simple visible smoke observation by on-road enforcement teams, as PM 2.5 emissions tend to be much higher from such “smokers” than from non-smokers. This is probably the easiest way to target emissions, reducing the need for direct notification, and providing a simple way for on-road inspection teams to select candidates for testing. TA recommends this approach.

A more complex procedure is followed in many industrialized nations. In Cairo, this would entail the following:

- ♦ Fully establish the on-road-testing program, including rigorous data analysis to identify vehicles that contribute significantly to poor air quality. Given that the GOE has now established an on-road testing program and will soon have three model test centers, the information gathered could provide excellent data for use in targeting high emitters.
- ♦ Rank vehicles by logical groupings (e.g. make, model, and year; or taxis, trucks, etc) along with an estimate of the relative populations of each. Profiles can include intensity of use as well as type of vehicle. Select a set number of the estimated highest polluters to match the testing capacity of the model centers.
- ♦ Notify owners of the targeted vehicles individually or associate the tests with their regular registration renewal process.

## Advantages and Obstacles of Targeting

### Advantages

- ♦ Provides rationale for expanding and formalizing on-road testing as both an enforcement mechanism and data collection tool. Does not require infrastructure investments or land acquisition. Coordination already established between MOI and EEAA participation in ORT.
- ♦ Enforcement of VET would be phased in. As model centers come on line and profiles are prepared, Traffic Departments would announce which vehicle populations are going to be targeted. Enforcement does not have to wait for completion of network, providing immediate political benefits.
- ♦ Private sector contractor would be responsible for fewer stations.
- ♦ Public acceptance more likely. Citizens see the worst polluters being targeted first, including public vehicles, and will be less likely to resist generalized testing. In a context where enforcement is unusual, public acceptance is critical.
- ♦ Such a process could maximize investment because limited resources target the minority of vehicles that are causing the majority of the pollution.

### Obstacles

- ♦ Traffic Departments would have to be persuaded to release data on vehicle fleets and coordinate notification of vehicle populations with EEAA. In general, the release of information is an obstacle for the existing VET program and must be resolved. This suggests relying on such simple targeting methods as visible smoke checks.
- ♦ Notification of targeted vehicle populations would be required.
- ♦ If enforcement was to begin with selected vehicles as soon as the Model Centers were completed, the MOU signed between EEAA and MOI might need to be modified, as the current MOU has no provision for enforcement before the entire network is complete. Under any scenario, given the delays the project has encountered so far in site location and construction, the current “no enforcement until network complete” strategy may need revision.

Adding economic incentives and/or targeted enforcement of vehicles needs more detailed study, but a cursory review suggests potential benefits. The design of the VET program has already evolved in significant and sometimes unexpected directions. The original USAID contract called for decentralized testing and repair in certified garages, while at present a centralized, test-only network is envisioned. Further changes were the addition of three model centers in addition to a full technical center; inclusion of safety inspections at the VET testing sites, and developing an road-testing program at the request of EEAA. Motorcycle standards were developed and incorporation of motorcycle testing into the VET network occurred at the request of EEAA. Exploring

the possibilities of a targeted VET program is a further effort to adapt to local circumstances and to accommodate local counterpart capabilities and needs.

## H. Summary Recommendations and Action Plan

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This report reviewed the status of VET activities undertaken so far, and raised issues about the long-term sustainability of the VET program. In this summary, tasks that would make a significant contribution to addressing some of these issues are presented. Some tasks, like the economic feasibility study, will serve to focus attention on outstanding policy and institutional issues. Others suggest modifying the scope of already planned or ongoing activities. The VET Working Group would undertake these tasks.

### Priority Recommendations

**Re-do economic feasibility models with new parameters.** The following elements should be included as variables and used for a “what-if” sensitivity analysis:

- ◆ Vehicle type (car, motorcycle, taxi microbus, light truck, heavy truck, bus).
- ◆ Frequency of inspection by vehicle type: for private cars, motorcycles, and agricultural trucks, this is every 3 years. For taxis, minibuses, and trucks, every year.
- ◆ Effect of safety inspections on volume of vehicles that can be tested at VET stations.
- ◆ Effect of mega-centers (fewer stations with larger capacities).
- ◆ Effect of individual failure rates for each vehicle type.
- ◆ Cost for re-test, for each individual vehicle type ranging from £E0 to full fee.
- ◆ Individual inspection fee per vehicle type.
- ◆ Effect of number of total staff/lane on station’s profitability.
- ◆ Effect of costs for safety inspections.
- ◆ Effects of targeted vehicle testing. What if only taxis are originally targeted, or minibuses, etc.

**Timing:** As soon as possible, since needed before tender.

**Finalize network design considering CAIP’s experience with the Model Centers and the existing EEAA/MOI MOU.**

- ◆ Redefine configuration of stations to include safety testing, and its effect on expected volume of vehicles that can be tested at VET stations.
- ◆ Address testing of large buses and trucks not currently included in VET design. Investigate whether contract tender could specify including one or two sites dedicated to large vehicle inspection or whether large vehicles could be included in on-road enforcement.

**Timing:** As soon as possible, since needed before tender.

**Specify EEAA oversight role vis-à-vis governorate, private sector contractor, and Traffic Departments.** Clarify who has legal authority over the contractor. Decide whether central EEAA, governorate environmental units, or Greater Cairo EEAA regional branch office is most appropriate. The VET Working Group should address the following issues:

- ♦ What entity will enter into the tender contract?
- ♦ How will EEAA be included?
- ♦ What substantive sanctions or inducements can be used to back up this oversight role?
- ♦ Clarify what functions are essential for EEAA to do as an environmental agency and whether some oversight functions should be handed over to the Traffic Departments or the governorates. EEAA functions should include:
  1. Institutionalized ability to evaluate network activities, through scheduled reviews of reports submitted by contractor.
  2. Ability to use data transmitted from the network to make regulatory recommendations, including how to evaluate whether standards are set correctly.
- ♦ Develop specific capacity building plans that address the agency's needs. This task may be broader than the operating procedures for the Technical Center.

**Timing:** As soon as possible, since needed before tender.

**Start phased or partial enforcement when Model Centers are completed.** This can be through on-road inspections or at the Model Centers; targeted to certain classes of vehicles (i.e., taxis) or for each governorate. This would require agreement from Traffic Departments and/or governorates and amending the MOU. The advantage is that Model Centers are used to their full potential while the network is being constructed.

**Timing:** After model centers are completed, before network is implemented.

**Consider using a two-phase tender.** Phase One would contract for operation of Model Centers. Phase Two would award the network to the same contractor if certain performance criteria were met. This would ensure that Model Centers are used as pilot centers, where roles and responsibilities among the contractor, EEAA, the Traffic Departments, and the governorate are worked out in advance of the complete network tender.

**Timing:** Ideally before the model centers are operational.

**Design low-emission tune up certification program (LETU Program).** Devise voluntary certification for participating gas stations, and offer a list of such stations at all VET testing stations.



**Timing:** As soon as possible.

**Continue CAIP/EEAA on-road testing.** ORT should continue until Model Centers are complete to gather in-use fleet information, raise public awareness, and allow public and private fleet testing. After Model Centers are completed, modify mandate of on-road testing to be on-road enforcement.

- ♦ Use ORT as either interim on-road enforcement before the network is complete or supplementary enforcement once the network is functioning. (Interim enforcement, as discussed above, requires the same amendment to the MOU between EEAA and MOI.)
- ♦ Selection of vehicles for on-road enforcement can be random, as is currently done for high emission vehicle profiling, and then targeted later, for instance, to smoking and grossly polluting vehicles.

**Timing:** Before network implementation.

**Proceed with adoption of in-use vehicle standards.** This includes standards for motorcycles and large vehicles, and help to establish mechanism for EEAA review of standards on periodic basis.

**Timing:** Before issuance of tender.

1. **Proceed with adoption of new vehicle standards.** Begin designing enforcement mechanisms for vehicle importers and vehicle assemblers. These tasks include:
  - ♦ Agree to timetable for adoption of new standards for cars and for motorcycles with Egyptian counterparts' assistance. Agree to require catalytic converters and other pollution control devices for new vehicles produced and assembled in Egypt.
  - ♦ Devise monitoring mechanism for enforcing new standards. CAIP can provide technical assistance as needed.

**Timing:** Before implementation of the network.

## Additional Recommendations

**Use on-road inspection to visually target smoking vehicles.** “Smokers” have been shown by the USEPA to have significantly higher emissions of fine particulates, the pollutant of most concern (along with lead) for CAIP. Many of these vehicles will be publicly owned, and/or large diesel-powered vehicles, which would help address two classes for which the VET program currently has no enforcement provisions. Other targeted vehicle emission strategies could be added as needed.

**Consider economic incentives or supplementary measures to enhance compliance of grossly polluting vehicles, especially motorcycles.** To be considered: mandatory retirements; subsidized loan programs for re-powering, retrofits, or use of pollution

controls. A potential model for this is the current GOE program for taxi conversions to compressed natural gas (CNG).

## VET COMPONENT

<i><b>TASK</b></i>	<i><b>Issues and Concerns</b></i>	<i><b>Transition Assurance Recommendations</b></i>
<b>A. VET NETWORK (PERT Task 9)</b>		
<b>A.1 Network Design</b>		
CAIP designed specifications for a centralized, test-only network to be contracted out to private sector contractor. MOU between EEAA and Ministry of Interior includes include safety inspections at all VET stations.	<p>Addition of safety inspections probably changes:</p> <ul style="list-style-type: none"> <li>Through-puts of VET stations</li> <li>Station costs</li> <li>VET fee</li> </ul> <p>Large vehicles excluded from current VET design. These represent significant contribution of diesel fine particulate emissions.</p>	<p>Re-do economic feasibility models with new parameters. (See Recommendation #1 for variables to be included.) Finalise network design considering CAIP's experience with the Model Centers and the existing EEAA/Ministry of Interior MOU.</p> <p>Redefine configuration of stations to include safety testing, and its effect on expected through-put for VET stations.</p> <p>Address testing of large buses and trucks, not currently included in VET design. Investigate whether contract tender could specify including one or two sites dedicated large vehicle inspection sites or whether large vehicles could be included in on-road enforcement.</p>
<b>A.2 EEAA Network Oversight</b>		
CAIP is responsible for developing operating procedures for the VET network, including helping to clarify institutional roles for the traffic departments, private sector contractor, and the EEAA.	<p>EEAA may have limited legal authority</p> <p>Will the VET Section under RBO's, EMU's, or central EEAA?</p> <p>What substantive authority will EEAA or Governorate have to hold private sector contractor to performance standards?</p> <p>What functions are essential for EEAA to do to assess if VET program is fulfilling its goals?</p>	<p>VET Working Group should</p> <p>Clarify what entity will enter tender contract, and how EEAA will be included.</p> <p>Identify how functions essential for EEAA as an environmental agency responsible for program review and regulatory recommendations will be accomplished.</p> <p>Identify role of Governorate EMU's and/or EEAA RBO's for Cairo VET and to help clarify roles for other VET programs, such as in Alexandria.</p> <p>Decide with EEAA what this will require in terms of staff, training, and resources; and plan to build the capacity of this VET Section as needed.</p>
<b>A.3 Network Tender</b>		

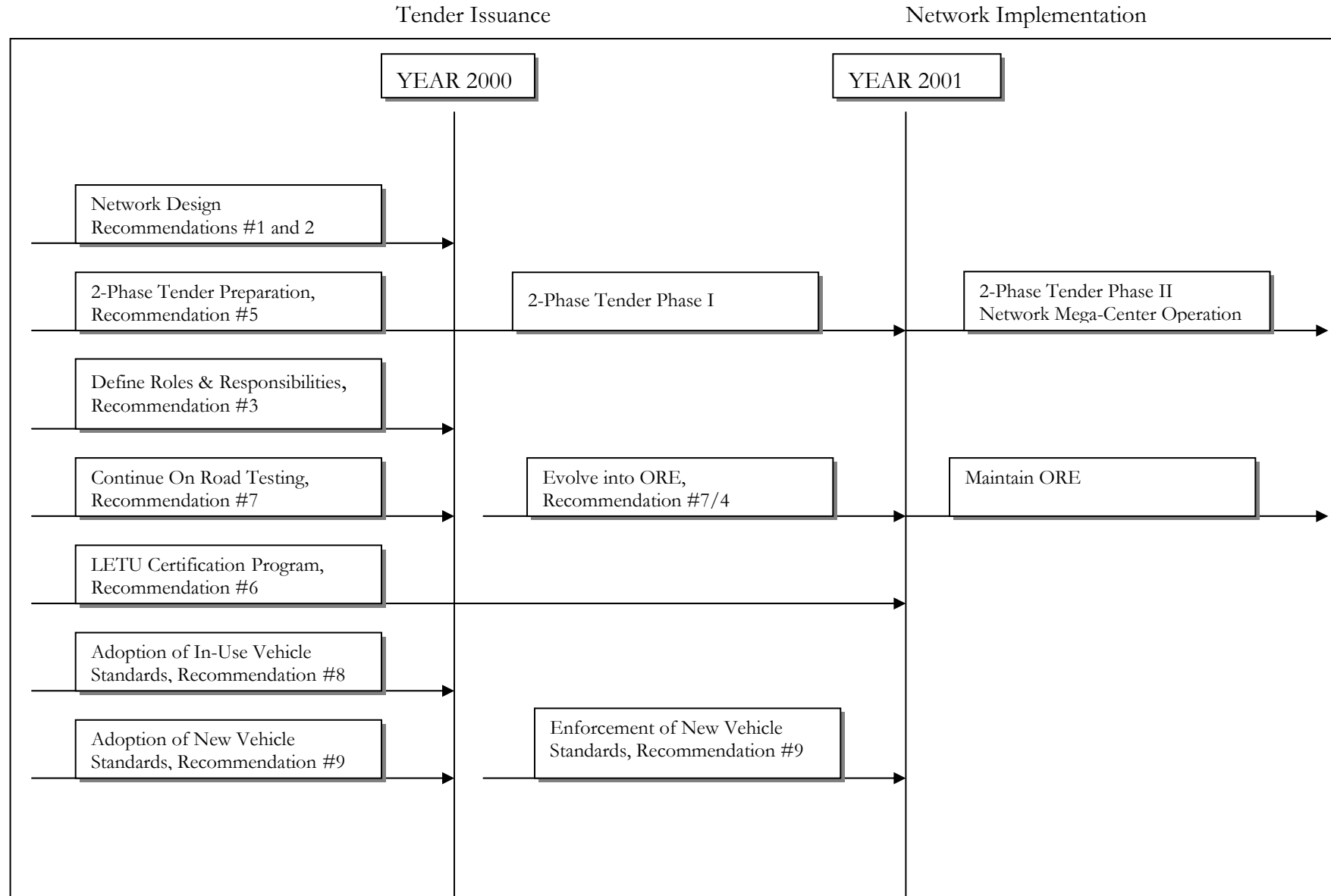
<i><b>TASK</b></i>	<i><b>Issues and Concerns</b></i>	<i><b>Transition Assurance Recommendations</b></i>
CAIP is to provide assistance in preparing the private sector tender document. CAIP has drafted a tender document, which needs revision as several relevant parameters have changed. It appears that EEAA cannot enter the contract on behalf of the GOE. Currently, the tender is not scheduled to be issued until after MOI issues a decree for enforcement.	No input from private sector into design of tender yet.  With current timing of tender document, private sector contractor will have no participation in Model Center operations. EEAA/CAIP are currently required to staff the three Model Centers until a private sector contractor is hired  Financial benefits to the private sector concession holder(s) are linked to the fee structure and revenue sharing protocols that are still undefined.	Early input of private sector sought for tender design. Consider using a two-phase tender. Phase One would contract out operation of the model Centers. Phase Two would award the network to same contractor if performance criteria were met. Phase One offers opportunity to private sector to gain operating experience and clarify procedural issues with Traffic and EEAA with virtually no investment (buildings, equipment, and training provided by CAIP). For EEAA/CAIP, this relieves the need to actually staff the Model Centers in the interim between tender signing and completion of the Centers.
<b>A.4 Financial Feasibility and Fee Structure</b>		
CAIP is to conduct financial feasibility studies as needed to provide input on proposed testing fees. The first CAIP financial feasibility study found through-put of cars is key to a profitable network. CAIP proposed two fee collection mechanisms, one paid through post office as are registration fees , the other collected at a kiosk at the testing site.	Fee should be equalised for all sites and portion will go to administrative oversight costs, but this has not been worked out. Before fee structure or collection mechanism is set, oversight between EEAA and Governorates/Traffic Department should be clarified, as this may add a new party to the fee structure and to discussions of collection mechanism.	Clarify who will be party to the VET fee. Re-do Financial feasibility study with new parameters. (See Recommendation #1 for variables to be included.)
<b>B. POLICY ISSUES (PERT Task 6)</b>		
<b>B.1 Enforcement and Compliance</b>		
Traffic department enforcement through registration renewal requirement, where vehicle testing certificate required for vehicle registration. Windshield sticker would allow easier on-road enforcement. Sufficient enforcement is necessary to make the private sector network viable.	According to the MOU, the Traffic Authorities will withhold licenses of non-complying vehicles only when the entire VET network is up and running. The Traffic departments have made clear they will keep the current 3 year vehicle registration. Windshield stickers have not yet been approved or designed. ORT at present does not have authority to require tune-up for the 34% failing the test.	Clarify implications of having three year registration renewal for passenger cars, motorcycles, and agricultural trucks. Phased Enforcement: consider modifying the MOU to allow limited enforcement as soon as a model center is completed, either for targeted or generalized testing. Maintain on-road testing and expand to on-road enforcement to get annual inspections and to supplement three year registration enforcement. Investigate economic incentives that can support compliance (e.g. buy-backs of grossly polluting vehicles, subsidized loans for repowering or retrofitting, and higher registration fees for grossly polluting vehicles, etc.) Targeted VET programs may also channel enforcement

<i><b>TASK</b></i>	<i><b>Issues and Concerns</b></i>	<i><b>Transition Assurance Recommendations</b></i>
		efforts to selected portions of the fleet.
<b>B.2 Vehicle Emissions Standards</b>		
CAIP is responsible for helping review existing emission standards, propose changes, and assist in adoption through ministerial decrees. CAIP, in conjunction with EEAA and the Ministry of Industry, proposed standards for all new vehicles sold or imported into Egypt based on European and American standards. Draft standards for new and in-use motorcycles were also put forward by CAIP.	Neither set of standards has been formally ratified yet by the Egyptian government. Currently, almost all new vehicle assembly and production plants in Egypt do not use up-to-date emissions control equipment. From the discussions of proposed new motorcycle standards, it became clear that manufacturer opposition to imposing new standards may be considerable	VET working committee should pursue: Timetable for adoption of new standards for cars and for motorcycles. Devise monitoring mechanism for enforcing new standards. CAIP can provide policy assistance. Apply new mechanisms to imports and assembly of new vehicles.
<b>C. Private Sector Tune-Up and Repair Capacity (PERT Task 7)</b>		
CAIP will provide required training to the private sector tune-up/repair facilities personnel. Quick start program distributed 29 EEAA-owned analyzers. CAIP is doing a study to clarify what is current low-emission tune-up capacity.	CAIP Quick Start showed initial eagerness for tune-ups, though interest in both service providers and motorists declined substantially over time without enforcement mechanisms in place. Vehicle owners who fail the VET test should know where to get reliable low-emission tune-ups. Will market interest be sufficient to expand tune-up capacity?	Public awareness materials at gas stations, garages, and VET stations on the benefits on low- emission tune-ups are important to sustaining public compliance. Devise way gas stations could be voluntarily certified and a list to be offered at all VET stations. Use Quick Start data and feasibility study to estimate how much profit effective low-emission tune-ups would provide garages. Expand existing linkages with gas stations and perhaps expand distribution and training on analyzers and low-emission focused tune-ups Investigate alternative economic incentives for tune-up as appropriate, including studying temporary subsidies on per test basis to participating garages.
<b>D. Model Centers (PERT Tasks 2-4)</b>		
Three model centers are to be constructed and equipped with emissions testing equipment. Land was designated for the Katameya Technical Center, A & E design contract was underway, but now site is being disputed. Land allocated for the Giza Model Center, and Qalubiyya (Shubra) Model Center; Cairo model site being negotiated. Construction has begun at Qalubiya Model Center, and is scheduled for completion by June or July of 1999; equipment procurement timing currently depends upon USAID/Chemonics contract modifications	Land acquisition of the VET Centers has proven difficult and time-consuming, with frequent reversals. Multiple claims to land by public agencies are common all over Egypt, a difficulty the private sector contractor will also face. In addition, land costs in central Cairo are high. Thus the original network design, which planned for up to 25 stations, significantly underestimates the difficult of site acquisition. Co-location of Giza Model Center with Traffic Dept. facilities has led to requests that	Consider mega-testing centers located on the perimeter of the city (ring road) to reduce the number of central sites needed. Expand the capacity of each station and reduce the number of stations required of contractor. Or consider formalized co-location of inspection sites with Traffic Departments for entire network. USAID, CAIP, and the VET Working Group should clarify the procedure for considering all such requests on behalf of the Traffic Departments. One trend thus far has been for various parties to make different promises to counterparts. Expand use of Model Centers during interim period by considering:

<i><b>TASK</b></i>	<i><b>Issues and Concerns</b></i>	<i><b>Transition Assurance Recommendations</b></i>
	<p>CAIP finance Traffic buildings.</p> <p>Current plan for use of Model Centers before network start-up does not use them to capacity.</p> <p>Current plan for Model Centers does not provide for pilot operation including private sector contractor.</p>	<p>Use two-phase tender to private sector contractor, who would be able to provide services for a fee, although the test would not be mandatory. This would require modifying the MOU, which specifies that all tests done by the Model Centers in the interim period will be free.</p> <p>Use Model Centers for targeted testing as they are completed.</p> <p>Public and private sector fleets could be tested at the Model Centers prior to network start-up.</p>
<b>E. STAKEHOLDER PARTICIPATION</b>		
<b>E.1 Stakeholder Coordination</b>		
Close cooperation with EEAA, Traffic Depts. of Greater Cairo, USAID, and eventual private sector contractor is required.	These linkages have not been institutionalized within the VET component, resulting in less than ideal counterpart input and communication.	<p>The appointment of a working committee with formalized counterpart roles for the VET component as soon as possible would help formalize these linkages.</p> <p>The component needs to hire several staff with expertise in policy issues and excellent linkages, or the ability to develop such linkages, with counterparts</p>
<b>E.2 Considering the public</b>		
Effective communication with the public regarding the VET program will be facilitated through the CAIP. Preliminary public awareness messages have been initiated by CAIP, particularly in support of the Tune-up Phase I and ORT activities.	Public awareness was shown to be particularly important in encouraging voluntary tune-up. Public awareness should not apply just to the public, but to CAIP: an awareness of what will foster public acceptance of the Vet program.	<p>Public acceptance of the VET program could be fostered by considering:</p> <p>Ability-to-pay in setting the fee for VET testing</p> <p>Inclusion of public vehicle fleets in VET testing to enhance public support. Otherwise, citizens will (rightfully) feel they are singled out while the government is let off. As state-owned vehicles are some of the most polluting, not addressing public vehicles will undermine public acceptance.</p> <p>Phasing-in compliance by beginning with a targeted program for grossly polluting vehicles with gradual expansion to all vehicles.</p>
<b>F. Possible Modifications/Additions to VET Program</b>		
<b>F.1 Targeted Vehicle Emissions Testing</b>		
Not currently part of CAIP activities, but does not add significantly to scope of current activities.	To achieve more environmental impact reduction per unit of enforcement effort, those vehicles with highest emissions should be targeted first where politically feasible. A targeted program would ideally address both the kinds of vehicles most	<p>Use on-road inspection to visually target smoking vehicles.</p> <p>“Smokers” have been shown by USEPA to have significantly higher emissions of fine particulates, the pollutant of most concern along with lead for the Cairo Air Improvement Project. Many of these vehicles will be publicly owned, and/or large</p>

<i><b>TASK</b></i>	<i><b>Issues and Concerns</b></i>	<i><b>Transition Assurance Recommendations</b></i>
	likely to pollute and those driven most. In Cairo, these groups overlap to a large extent	diesel, which would help address the two classes for which the VET program currently has no enforcement provisions.
<b>F.2 Additional Compliance Incentives</b>		
Not currently part of CAIP activities. Could add a range of requirements depending on which measures were selected.	Three year registration requirements for many vehicles may warrant considering economic incentives to foster use of low-emission tune-ups. Mandatory retirements are another option.	<p>Measures could include buy-backs or mandatory retirements of grossly polluted vehicles. At a minimum, waivers for grossly polluting vehicles should require re-testing every year.</p> <p>Subsidized loans for repowering or retrofitting motorcycles with pollution controls. Existing GOE programs for CNG conversion provide a possible model. Implementation for these loan programs is through the Social Fund for Development and/or selected private banks. CAIP has done some prior work on such measures.</p> <p>Incentives can be targeted by using information gained from high emitter profiling (described below).</p> <p>Incentives for low-emission tune-up garages are covered under Task #7.</p>

## SUSTAINABILITY STUDY: SUMMARY OF MAIN RECOMMENDATIONS





## **II.**

### **Compressed Natural Gas (CNG)**

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#### **I. Introduction**

The objective of the CAIP CNG component is to reduce particulate emissions by expanding the use of CNG fuel in Cairo's public transit fleets. While the GOE has a strong political commitment to using CNG given Egypt's vast natural gas reserves, the cost of CNG is not competitive with diesel fuel, which is heavily subsidized. Although gasoline-powered vehicles are being converted to CNG in increasing numbers through loan programs created to finance conversion, the use of CNG in transit fleets faces several obstacles, including:

- ♦ CNG costs more than diesel fuel.
- ♦ Dedicated CNG buses cost more than their diesel counterparts.
- ♦ CNG technology is sophisticated and not widely understood in Egypt.
- ♦ CNG-fueled buses require adopting new operation and maintenance systems.

Political directives and central budget allocations to buy CNG rather than diesel buses compensate for some of these cost differences, and CAIP is addressing the institutional support and training aspects required for operation of the pilot CNG fleet.

All of the CNG component's counterparts are committed to the project. Coordination with the CNG staff needs to be formalized through regular Working Group meetings.

#### **Stakeholder Expectations**

##### **Misr Lab**

The Organization for Energy Planning (OEP) within the Ministry of Petroleum is CAIP's counterpart and the main recipient of the project's work with Misr Labs. OEP expects a complete certification lab for both light- and heavy-duty vehicles. These capabilities would provide valuable services to EEAA's regulatory framework for vehicle

emissions if the lab were used to enforce new vehicle emissions standards and conduct mobile source pollutant inventories.

### **Cairo Public Transit Companies**

The Cairo public transit companies, Cairo Transit Authority (CTA) and Greater Cairo Bus Company (GCBC) are the primary beneficiaries of the pilot CNG bus fleet. The transit companies expect delivery and certification of the pilot CNG buses; a maintenance facility to be built for CTA and one to be modified for GCBC for the CNG buses; operations and maintenance systems to be developed, and training for CNG-related employees. They also expect that to strongly influence use of any second phase procurement funds.

The transit companies may also benefit as the result of direct and indirect subsidies for CNG use, to help counteract the government subsidy for diesel fuel.

### **Public Benefits**

Requiring vehicle emission testing and tune-up of diesel transit vehicles or requiring that diesel vehicles be retrofitted with pollution control devices would have the most immediate public health and air quality benefits for the general public. However, these activities are less likely to be championed by either OEP or the transit companies. Integrating testing of transit vehicles and large trucks fueled by diesel into the VET network design should be carefully considered.

## **J. Procurement**

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### **CNG Transit Bus Chassis**

The CAIP project design called for procuring five complete CNG buses initially. These were received in late 1998. One is a classroom bus, to be used for training and public awareness activities, and four are mid-size buses that were to have been used for employee transportation by the MOE and OEP. However, the classroom bus has not been used extensively because of insurance issues, and the other pilot buses are not licensed yet because the seats face the wrong way under Egyptian rules.

The largest procurement was planned to be a trial fleet of 25 minibuses and 50 buses. CAIP procured 50 full-size bus rolling chassis from the US in January 1999, but the minibus procurement was cancelled due to technical concerns. Two prototype full-size bus chassis will be delivered in late 1999 for testing and training purposes, and to initiate the assembly of the chassis with locally-manufactured bus bodies. Delivery of the remaining chassis will be by batches over the following several months.

## Recommendations

There seems to be consensus that the US\$180,000 price per chassis is likely to prevent replicating these specific chassis, as the transit companies simply do not have sufficient funds. The transit companies say there is a minimum number of CNG buses required to make operations and maintenance procedures economical. CTA suggested 100 buses, and GCBC suggested 200. In light of recent decisions by the Governor of Cairo that replacement buses should be CNG-fueled, not all these buses will need to be funded by USAID. Developing a sustainable operations and maintenance system for the bus companies is now the CNG component's most important task to enhance sustainability. This may require a larger investment in terms of both time and money than originally expected, given current practices and obstacles to improvement.

Since the rolling chassis procurement is not likely to be repeated because of the high cost of each individual chassis, planning for replication should be a major criteria for any new procurements. Ideally, however, any such procurement should be designed in consultation with interested local manufacturers. If procurements are cheaper from countries other than the US, technical assistance could be provided through sample tender documents, specifications, and warranties. Second phase options could also be focused on policy activities with the Ministry of Petroleum to provide direct subsidies either for CNG fuel or for transit company purchases of CNG vehicles. Some of the easiest subsidies to enact would be exemptions from customs duties, tax breaks, or reduced fuel pricing at the National Gas Vehicle Company (NGVC) stations that will be built for refueling the initial fleet of CNG buses at each of the transit companies.

Based on the experience with the initial five buses procured, the TA team believes that procuring buses may not be the most effective way to address transit bus fleet emissions or encourage the use of CNG fuel. Although policy elements have been present since the design of the project, until now the emphasis for the CNG component's work from USAID, CAIP, and the bus companies has been on procurement. In part, this is because the potential beneficiaries of broader approaches (such as the public) cannot be included directly, and because few cost-benefit evaluations of alternative approaches have been undertaken. TA recommends completing these basic evaluations before further procurement is undertaken.

### CNG Transit Bus Bodies

The transit companies allocated funds for purchasing locally-manufactured bus bodies and assembling them with the US-made chassis. They agreed to issue a combined tender for the bodies to a local manufacturer. CAIP and CTA have developed the bus body specifications. These will be confirmed by Sargent, the US chassis provider, which is required to provide technical assistance through the body building and assembly process.

## Recommendations

CAIP assistance in reviewing the bus body tender for the transit companies and following up with Sargent is crucial to ensure adequate communication between the local bus body builder and Sargent. The information obtained from the local body building and assembly companies can help assess local capacity for CNG assembly and manufacture of selected components.

The transit companies have raised a number of issues regarding coordination between Sargent and the body builder, including how two separate warranties and performance certifications will be integrated. At present, the transit companies want every bus tested in Cairo. CAIP and USAID should negotiate an agreement that will result in a sample of the buses being tested. Testing facilities at Misr Lab must be completed before this testing can take place, which should be feasible.

The technical work done by CAIP on the chassis and bus body specifications should reside with the transit companies so that when the transit companies issue an international tender for more CNG buses, this work does not need to be redone. CAIP might indicate its willingness to draw up a prototype international tender based on prior work. This work would benefit not only the Cairo transit companies, but also the Alexandria Transit Authority, which is in the process of trying to acquire Italian CNG buses.

## Second Phase Procurement

The transit companies expect that the second phase of CAIP's procurement funds for CNG activities will be used in accordance with their wishes. OEP's role in setting policy directives is crucial in this respect. For example, it may be simpler and less costly to procure dedicated CNG minibuses than US-made rolling chassis, which are too expensive to be replicated using local funds. In this case, project counterparts would not simply be the two transit companies, but the many private sector minibus companies and operators. The transit companies, however, are likely to want more buses to address the extremely high demand placed on their existing fleets.

## Recommendations

TA recommends that the CNG component clarify with their stakeholders that these funds are to support the general objective of encouraging CNG use as a transit fuel, and that this may or may not mean more bus procurements

Since the GOE's commitment to procuring further CNG buses is strong, remaining project funds should be directed to ensuring that the operation and maintenance systems developed for the transit companies work and are adequate for larger fleets of CNG buses.

If additional procurements are undertaken, dedicated CNG minibus procurements should not be ruled out. Although the transit companies prefer additional full-size buses, importing whole minibuses might be cheaper, arguably more durable, and perhaps easier to maintain. Minibuses could fuel at NGVC stations around Cairo and could be more easily serviced, as such services are available for the taxis and minibuses that have already converted to CNG.

Focusing primarily on procurements for the two transit companies may preclude considering other options that CAIP could deliver more effectively. Assisting the transit companies to design a replicable international tender for CNG bus procurements, or assisting OEP with policy work on economic incentives for microbus conversion would be additional ways that CAIP could work to ensure sustainability

## **K. Transit Bus Operations, Maintenance, Training, and Institutional Support**

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### **CNG Maintenance Infrastructure**

CAIP is to provide CNG maintenance facilities for both CTA and GCBC. The CNG team proposed separate maintenance organizations specifically for CNG buses. This consists of a new garage for CTA and a remodeled garage at GCBC, dedicated CNG maintenance teams, a computerized maintenance information system for service scheduling and inventory control, and quality assurance/quality control procedures. CAIP has provided draft designs for the garages, and the transit companies allocated sites for the garages. NGVC has agreed to build fueling stations at each of the CNG garages.

### **Recommendations**

Because the first of the 50 CNG buses will have been assembled before the CTA garage is completed, the CNG team will need to work with CTA to come up with an interim solution to meeting garage infrastructure requirements.

The staggered finish dates for garages will make it difficult to coordinate training between the two garages. This will necessitate CAIP providing refresher courses when the CTA garage is completed.

Each garage should be capable of maintaining 100 buses and accommodating up to 1,200 employees. Since the garages will initially be responsible for 25 buses each, with an estimated staff of 285, provision must be made for replicating training within the transit companies as more buses and more employees are added.

The transit companies requested specifications for the garage equipment, to proceed with garage construction and modification. TA recommends clarifying which equipment will

be provided by the project and which by the transit companies, as well as the number of buses to be serviced through project procurements.

The transit company chairmen have expressed concern that NGVC has not yet begun to work with them to build fueling stations. TA recommends involving the OEP as mediator, having necessary authority under the Ministry of Petroleum.

OEP is also a needed partner in reducing custom duties for future CNG-related spare parts. This task could be expanded into developing indirect subsidies for CNG use.

## CNG Transit Bus Training and Institutional Support

CAIP is to provide institutional support and training to the transit companies to ensure the long-term sustainability of CNG buses in the bus fleets. This is the most challenging task of the CNG component.

A 1993 study, “Present Situation of Public Transport Service” by Cairo reports that more than half the existing fleet was past its proposed age of retirement. The buses were used for more than 18 hours daily. The number of passengers per bus per day was higher than international norms (1,833 passengers versus an international norm of 1,500). Fully 23 percent of the existing fleet was out of service because of maintenance problems while only 70 percent of the fleet was in use.

These trends, the study claimed, would only worsen as passenger volume increased by a projected 6–8 percent/year in the latter half of the 1990s. The greatest need was for more buses and more minibus routes, as these two forms of public transit carried the vast majority of Cairo residents. Without sufficient additional buses, the buses were being run for more hours per day. The number of kilometers being traveled per day had increased by 29 percent over the past decade, contributing to the frequency and severity of breakdowns.

It is no surprise, then, that the transit companies’ overriding interest is having more buses on the road to help alleviate the demands on the fleet.

The proposed *CAIP Institutional Support Plan* reviewed conditions at the transit companies and reported similar problems. Major problem areas identified in the current Operation and Maintenance (O&M) system for diesel buses included erratic supplies and shortages of spare parts due to a centralized and sub-optimal tracking and request system.

CAIP staff observed that technicians are assigned to certain buses and only these buses. This means that if CTA and GCBC intend to eventually put the CNG buses on different routes, more technicians will need to be trained. At present, CTA has indicated all their CNG buses will be used on the Tahrir Square–Airport route, which has a limited number of kilometers and passengers.

## Recommendations

Attention to institutionalizing safe maintenance practices is a critical priority. The margin for errors in maintenance and repair with CNG buses is smaller than with diesel-fueled vehicles. In particular, the fuel system must be maintained regularly in order to be operated safely.

Large CNG vehicles are at the forefront of vehicle technology. Cummins Engine Co., the only US manufacturer to make dedicated CNG truck engines, recently closed its production lines due to inadequate demand. The transit companies' concern with adequate and affordable spare parts is justified. A more valuable alternative to procuring additional buses might be pursuing a long-term service and spare parts contract with Sargent.

Ensuring a functional CNG infrastructure would contribute to long-term sustainability, as maintaining the pilot fleet safely would support efforts by the Cairo Governorate to purchase new CNG buses.

TA is concerned that retaining qualified staff and making changes in management culture as proposed in the *CNG Institutional Support Plan* will require a greater time and budgetary commitment from both the project and the transit companies than currently envisioned. The plan includes introducing a new electronic maintenance information system (EMIS) for each garage that will require staff to have computer skills and to develop inter-departmental coordination. As the *Institutional Support Plan* pointed out, these conditions are not currently found in the transit companies and will require hiring new staff, retraining old staff, and changing current management practices. At public sector salary rates, recruiting and retaining qualified computer people is difficult. TA feels that introducing the EMIS will require an even greater adjustment than anticipated, in that almost all staff must have computer skills to enter and retrieve needed data.

CAIP and the transit companies should attempt to develop supplementary wages for CNG maintenance staff to support the idea of an elite cadre within GCBC and CTA, especially for computer professionals.

Training requirements for the EMIS will be considerable. Simplifications to the proposed system should be made if it seems that sufficient resources will not be available. For instance, information in the fuel lanes could be recorded manually rather than directly to a computer, and then delivered to a central area for data input. Data on fuel system inspections could similarly be done manually, signed by a supervisor, then delivered to the computer network center. A similar approach could be taken to data retrieval functions of the EMIS. If the system indicates spare parts are needed, this information could be delivered in paper form from the central computer staff. This would require a larger dedicated computer staff, but more limited computer skills on the part of the majority of staff.

Ongoing funding for maintenance of these CNG buses may be jeopardized unless enough of them are procured to be a significant part of the Cairo fleet. This means that CAIP may want to provide information on how CNG buses can be procured at the most reasonable cost. The Alexandria Transit Authority is currently investigating procuring buses from an Italian manufacturer. Perhaps Sargent could be asked if they would lower the cost of chassis if further orders for buses were confirmed.

## L. Emissions Testing and Certification Lab

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CAIP is to provide Misr Lab with the necessary equipment, installation, and training to perform emission and performance vehicle testing. The lab is to produce data on emissions from CNG and diesel heavy- and medium-size vehicles. The CNG team developed specifications for the lab equipment. Whether Misr Lab is to have new vehicle certification capacity, however, has been a source of debate.

Misr Lab could perform an important role in assisting EEAA establish a regulatory framework for vehicle emissions. If Misr Lab is equipped as a certification lab, it will be capable of verifying compliance with proposed new vehicle emission standards. As argued in the VET section, enforcing new vehicle standards is critical as the Cairo fleet modernizes and expands. According to the Central Agency for Public Mobilization and Statistics (CAPMAS), 50.1 percent of all vehicles in Egypt were locally produced as of 1996. Although local production includes imported parts, new vehicle car do not currently have to meet the emission requirements that are standard for the same make and model in other countries, according to *The Car Industry in Egypt*, Middle East Library for Economic Services, 1999. As a certification lab, Misr Lab could also assist EEAA in developing accurate pollutant emission inventories for mobile sources and assessing the effectiveness of vehicle emission control strategies over time.

The VET stations are not equipped to fulfill these functions. The VET stations test individual vehicles and ensure that they comply with defined standards based on simple test procedures. Misr Lab, in contrast, would provide realistic measurements of in-use emissions (not at-rest tailpipe emissions). They could verify that new vehicle models comply with the more complex and thorough emission regulations that are to be established for new vehicles. Without this capability, EEAA will have to rely on certifications given by the vehicle assemblers and manufacturers, which do not have in-country capability to test their own emissions.

## Recommendations

To integrate the certification capabilities of Misr Lab into EEAA's regulatory strategy for vehicle emissions, TA recommends the following steps be taken:



- ♦ CAIP facilitate a formal MOU between the Ministry of Petroleum and EEAA to share the use of the results of Misr Lab's testing in order to (1) verify new vehicle standards; (2) conduct mobile source pollutant inventories; and (3) monitor vehicle emissions approaches and strategies.
- ♦ The MOU could also specify which agency is EEAA's counterpart for enforcing new vehicle standards, and how new vehicle manufacturers and assemblers will be monitored.
- ♦ The MOU could also clarify how public transit vehicles will be tested in the VET network or at Misr Lab. If in the VET network, a dedicated heavy-medium vehicle lane should be added at one or two testing stations. If at Misr Lab, clarification is needed on who will have authority to monitor the testing and require tune-up reports.

## M. Policy and Regulatory Issues

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The CNG component aims to reduce transit emissions by encouraging the use of CNG as a fuel. Given the diesel price incentives and government budget constraints on purchasing new buses, it is unlikely that a majority CNG transit fleet will be a reality for many years to come. There are a number of measures CAIP could undertake in the meantime to reduce transit emissions as well to encourage the use of CNG.

The CNG team prepared a report outlining options for second phase procurements/policy choices. The CNG component has focused on procurement, fulfilling USAID's contractual performance standards for CAIP, which are largely procurement-driven. However, policy questions must now be addressed.

### Regulatory Framework

CAIP is to help the GOE establish effective and comprehensive CNG safety standards, licensing and certification procedures, and enforcement mechanisms by appropriate authorities. CAIP developed proposed standards for component installation in vehicles, pressure vessels (cylinders), and fueling stations. The CNG team has contributed technical assistance to the Egyptian Organization for Standards (EOS) Committee as they consider adopting CNG standards. CAIP's Year 2 Work Plan calls for an institutional development plan to lay out how to enforce these standards.

Enforcement and certification are the real challenges once standards are adopted and compliance with these standards can be expected. The most crucial aspect of the standards is to reduce the public safety hazards of CNG-powered vehicles. Safety standards should receive first enforcement priority.

## Policy Framework

The Egyptian government has made using CNG a priority for strategic reasons based on the country's extensive reserves. Measures to encourage CNG's use have included a mix of economic incentives and ministerial actions. Fourteen thousand vehicles have been converted as of April 1999, including approximately 8,000 taxis. Economic incentives for conversion from gasoline include a subsidized loan program funded by the Social Fund for Development via the National Bank of Egypt and Commercial International Bank. Demand for conversion has exceeded natural gas infrastructure capacity, a problem the government is trying to remedy. The Ministry of Petroleum has established more natural gas fueling stations and NGVC is adding conversion centers.

Administrative measures have been government decrees with limited effect. For example, Cairo's Governor recently ordered all minibuses to convert to CNG as a condition of license renewal. Minibus owners greeted this order with outrage, and are largely ignoring it. The governor has now instituted a grace period for the conversions to be made. This is a good example of administrative rule-making not equaling implementation: conversion stations could not handle the volume if the owners did convert, and the cost of conversion was not considered at all.

Within the transit fleets, four Italian CNG-powered buses were imported and a British project plans to re-power an existing bus with a CNG engine. The Italian buses have an insufficient organizational support structure within the transit companies and are maintained by frequent visits from the local company representative. The CAIP project design called for conducting a re-powering feasibility study, but this study was put on hold at the request of GCBC and CTA to focus CAIP energies on bus procurement.

## Recommendations

Although the most effective means to encourage use of CNG would be to reduce the diesel subsidy, TA does not see this as a promising policy avenue at the moment. Like many countries including the US, Egypt subsidizes diesel fuel as a transport and agricultural fuel. As tractors, combines, and mechanized irrigation machines are largely fueled by diesel, lifting or reducing the diesel subsidy is unlikely.

However, implementation of subsidies for CNG use to balance the diesel subsidy could be pursued. One of the CNG component's required reports, "The Diesel Pricing and Incentives Study," should focus on how to bring incentives for diesel and natural gas vehicles in line with the social costs of each by investigating the most promising direct and indirect subsidies for CNG use.

To ensure sustainability, economic incentives that are simple to administer, target only CNG use, and do not impose regressive social costs should be prioritized, such as:

- ♦ Tax exemptions for firms in the business of CNG conversion, assembly, or supply.

- ♦ Exemptions from customs duties for CNG transit equipment and supplies.
- ♦ Lower licensing fees/fee exemptions for CNG-powered vehicles.
- ♦ Expansion and modification of loan programs like the Social Fund program to make conversion of diesel vehicles to CNG attractive. For example, new CNG minibuses purchased by the private sector could be subsidized or made more accessible by inclusion in such programs as the Commodity Import Program.
- ♦ Local manufacturing/assembly support. Work to reduce constraints on local assembly and manufacture of CNG components. Given the numbers of taxis and minibuses that would be converted, supporting local capacity for these smaller vehicles rather than transit buses might use CAIP resources more effectively.
- ♦ Work with microbus and mini-bus companies for either diesel tune-up or CNG use. CNG vans can be imported from the US that are durable and inexpensive. Options could also be explored for Egyptian assembly of US components or to build Egyptian chassis locally for minibuses.

If the work of the CNG component is more broadly defined as being the reduction of emissions from public transit fleets in Cairo, CAIP should consider whether inspection and tune-up of existing diesel buses or retrofitting buses with new diesel technologies would be a cost-effective interim solution until new buses are purchased.

Inspection and tune-up of the transit fleet could be integrated into the design of the VET network. At present, the VET network has no provisions for heavy and medium vehicles. By adding a dedicated heavy transit lane to one or two stations, public fleet testing could be included. Since CAIP will already be working closely with the transit companies, raising awareness with GCBC and CTA about the requirements of Law No. 4 and ensuring their cooperation in such testing and tune up should be possible.

As diesel transit vehicles and trucks are one of the most significant sources of fine particulates and carcinogenic compounds in Cairo's air, requiring tune-up of these vehicles is more important on a per vehicle basis than testing the average passenger car. Transit vehicles cover many more kilometers per day, and are largely operated within the confines of the Cairo urban area. As suggested in Section I of this report, including testing of public buses, minibuses, and trucks has several non-environmental benefits as well, as it would raise public confidence in the VET program as a whole.

## CNG COMPONENT

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>Task 2 Procurement of CNG Transit Vehicles</b>		
<b>2.1 Procure CNG Rolling Chassis</b>		
CAIP procured 50 rolling bus chassis from the U.S. The minibus procurement was cancelled due to cost concerns. Two chassis prototypes will be delivered in late 1999 for testing and training purposes and to initiate the local bus assembly. Delivery of the remaining chassis will be in batches over the following several months. CAIP is also to assist in planning for using 5 USAID-purchased buses.	<ul style="list-style-type: none"> <li>• Since the rolling chassis procurement is not likely be repeated for cost concerns, replication should be a major criteria for any new procurements. These concerns are addressed under 2.2 and Task 7.</li> <li>• The transit companies have raised a number of issues regarding coordination between Sargent and the body builder, including how two separate warranties and performance certifications will be integrated.</li> </ul>	<ul style="list-style-type: none"> <li>• CAIP should serve as a liaison between Sargent and the local bus body builder for the transit companies.</li> <li>• The testing procedures for the integrated bus body and chassis need clarification. "Certification" and testing of each bus is time-consuming and sampling would be simpler.</li> <li>• Buses should be covered by the warranty up to to 50 degrees C as requested by transit companies. Requests by the bus companies for spare parts of significant components (including engine and fuel injection system) understate difficulty of repairing these systems. Ongoing service contract and spare part supply agreement with Sargent would be more useful.</li> </ul>
<b>2.1 Assistance with Bus Body Tender</b>		
The transit companies allocated funds for the bus bodies and agreed to issue a combined tender for the bodies to a local manufacturer. CAIP is currently developing the specifications. These will be confirmed by Sargent, who is required to provide technical assistance to the body building and assembly process.	CAIP assistance on the bus body tender to the transit companies is crucial to ensure sufficient coordination between the U.S. chassis builder and the Egyptian bus body builder.	The information obtained from the local build and assemble companies can help assess local capacity for CNG assembly and manufacture of selected components. Technical work done by CAIP on the chassis and bus body specifications should be stored with the transit companies for future use by the transit companies. CAIP could indicate its willingness to draw up a prototype international tender based on prior work. This work would benefit not only the Cairo transit companies, but also the Alexandria Transit Authority, which is in the process of trying to acquire Italian CNG buses.

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>2.2 Second Phase Procurement Decisions</b>		
<p>A timely decision on the remaining CNG component funds is needed.</p>	<ul style="list-style-type: none"> <li>• The transit companies expect that the “second phase” CAIP procurement funds will be used for them.</li> <li>• Cost of first procurement was prohibitive for additional procurements of those specific chassis.</li> <li>• Developing an adequate operation and maintenance system for the pilot fleets may require both more time and funds than currently anticipated.</li> <li>• Underlying disincentives to CNG use in transit fleets remain and are substantial. They include : the higher cost of CNG fuel vis-à-vis diesel; the higher cost of CNG buses vis-à-vis diesel buses, the unfamiliarity and sophistication of CNG technology, and adopting new operation and maintenance systems.</li> </ul>	<ul style="list-style-type: none"> <li>• GOE commitment to procuring further CNG buses is strong, so remaining funds should first be directed to ensure that CAIP’s operation and maintenance works and is adequate for larger fleets.</li> <li>• Secondly, funds should be directed to establishing simple economic subsidies for CNG use to counter the strong disincentives. OEP’s role in setting policy directives is crucial in this respect. Second phase options can focus on policy activities with the Ministry of Petroleum to provide direct subsidies either for CNG fuel or for transit companies purchasing CNG vehicles.</li> <li>• If procurements are desired, dedicated CNG minibus procurements should not be ruled out. Although the transit companies are expressing preferences for buses, importing minibuses might be cheaper, arguably more durable and easier to maintain. Minibuses could fuel at NGVC stations around Cairo and could be more easily locally serviced as taxi and gasoline microbuses have already begun conversions to CNG.</li> </ul>
<b>Task 4 CNG Maintenance Infrastructure</b>		
<p>CAIP proposed a separate maintenance organization specifically for the CNG buses at both of the transit companies. This consisted of a new garage for each company, dedicated CNG maintenance teams, a computerized maintenance information for spare parts and service scheduling, and a quality assurance section. CAIP has provided design drafts for the CTA &amp; GCBC garages, and the transit companies allocated sites for the garages. The CTA garage will be a new facility, while GCBC will modify an existing garage.</p>	<ul style="list-style-type: none"> <li>• The buses will assembled before the CTA garage is completed.</li> <li>• Each garage should be capable of maintaining 100 buses and accommodate up to 1200 employees.</li> <li>• The transit companies requested specifications for the garage equipment so they can proceed with the garage constructions and modifications.</li> <li>• Although CAIP has been assured by the Natural Gas Vehicle Company (NGVC) that they are willing to build a fuelling station at the transit garages, the transit chairmen expressed concern that NGVC has not begun work with them.</li> </ul>	<ul style="list-style-type: none"> <li>• . CAIP needs to work with the bus companies to come up with interim solutions to meeting the garage infrastructure requirements. More importantly, it will be difficult to co-ordinate training between the two garages given the different completion dates. This will necessitate CAIP providing ‘refresher’ courses when the CTA garage is completed if the initial trainings were provided for both companies at the same time.</li> <li>• Since the garages will initially operate 25 buses with an estimated 285 employees, provision has to be made for replicating trainings by the transit companies as more employees and more buses are added.</li> <li>• Clarify which garage equipment will be provided by the project and which by the transit companies, as well as the number of buses to be serviced through project procurements.</li> <li>• Involve OEP to clarify situation with NGVC, as OEP is under the Ministry of Petroleum. OEP is also a needed partner in reducing custom duties for future CNG-related spare parts. This task could be expanded into CAIP work with OEP to set indirect and direct subsidies for CNG use vis-à-vis diesel.</li> </ul>

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>Task 5 Training and Institutional Support for CNG Buses</b>		
<p>CAIP is to provide institutional support and training to the transit companies to ensure the long-term sustainability of CNG buses in the bus fleets. Attention to institutionalizing safe maintenance practices is a critical priority. The CAIP plan includes introducing a new “electronic maintenance information system” for each garage which will require several skilled computer professionals, inter-departmental coordination, and basic computer tasks from many employees. Given the obstacles, ensuring a functional CNG infrastructure might be a greater contribution to long-term sustainability than procuring more buses. Maintaining the pilot fleet well and safely would support efforts by the Cairo governorate to purchase new CNG buses.</p>	<ul style="list-style-type: none"> <li>Recruiting and retaining qualified staff and making changes in management culture may require greater time and budgetary commitments from both the project and the transit companies than currently envisioned. The existing maintenance operations at the transit companies are inadequate for the existing fleet as well as the CNG pilot buses. At public sector salary rates, finding qualified computer people is difficult.</li> </ul>	<ul style="list-style-type: none"> <li>Arrange supplementary financing for the CNG maintenance staff so that the idea of an elite cadre within GCBC and CTA is backed by higher wages, especially for computer professionals.</li> <li>Training requirements for the EMIS system will be considerable. Simplifications to the proposed EMIS system should be made if it seems that sufficient resources will not be available ongoingly. For instance, information in the fuel lanes could be recorded manually rather than directly into computers, and then delivered to a central area for data input. Data on fuel system inspections could similarly be done manually, signed by a supervisor, then delivered to the computer network center. A similar approach could be taken to “output” functions of the EMIS. If the system indicates spare parts are needed, this can be delivered in appropriate form to the appropriate department. This would require a larger dedicated computer staff, but less computer literacy on the part of the majority of staff.</li> </ul>
<b>Task 6 Emissions Testing and Certification Lab</b>		
<p>CAIP is to provide Misr Lab with the necessary equipment, installation, and training to perform emission and performance vehicle testing. Under the CNG component, the Lab is to produce data on emissions from CNG and diesel heavy and medium size vehicles.. Whether Misr Lab is to have new vehicle certification capacity, however, has been a source of debate. CAIP developed specifications for the certification lab equipment.</p>	<p>If Misr Lab is equipped as a certification lab, it will be capable of verifying compliance with proposed new vehicle emission standards. As argued in the VET Section, enforcing new vehicle standards is critical as the Cairo fleet modernizes and expands. As a certification lab, Misr Lab could also assist EEAA in developing accurate pollutant emission inventories for mobile sources and assessing the effectiveness of vehicle emission control strategies over time.</p>	<p>To integrate the certification capabilities of Misr Lab into EEAA’s regulatory strategy for vehicle emissions, as proposed above, transition assurance recommends the following steps be taken in addition to equipment procurement.</p> <ul style="list-style-type: none"> <li>CAIP could facilitate a formal memorandum of understanding between the Ministry of Petroleum and EEAA for sharing the use and results of Misr Lab in order to 1) verify new vehicle standards; 2) conduct mobile source pollutant inventories; and 3) monitor vehicle emissions approaches and strategies.</li> <li>The MOU could also specify which agency is EEAA’s counterpart for enforcing new vehicle standards, and how new vehicle manufacturers and assemblers will be monitored.</li> <li>The MOU can clarify how public transit vehicles will be tested in the VET network or at Misr Lab. If in the VET network, a dedicated heavy/medium vehicle lane should be added at one or two testing stations. If at Misr Lab, clarification is needed on which agency will have authority to monitor the testing and require tune-up reports.</li> </ul>
<b>Task 7 Creating a Policy and Regulatory Environment Conducive to CNG Use</b>		

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>7.1 Regulatory Framework for CNG</b>		
CAIP is to help GOE establish effective and comprehensive CNG safety standards, licensing and certification procedures, and enforcement mechanisms by appropriate authorities. CAIP developed proposed standards, and they are under review at EOS.	Enforcement and certification are the real challenges once standards are adopted and enforcement of these standards can be expected to partial.	The most crucial aspect of the standards is to reduce the public safety hazards of CNG powered vehicles, and thus CNG standards should receive enforcement priority. The difficulty in enforcing standards means CAIP should focus on ensuring the transit companies have an adequate maintenance system.
<b>7.2 Policy Framework for CNG</b>		
<p>Given incentives for using diesel and government budget constraints on purchasing new buses, it is unlikely that a mostly CNG fleet any time soon. Thus Task 7 recommendations include a number of measures to reduce transit emissions as well to encourage the use of CNG.</p> <p>A CAIP CNG “White Paper” was prepared with several options for second phase procurements/policy choices.</p>	<p>Although the most effective means to encourage use of CNG would be to reduce the diesel subsidy, transition assurance does not see this as a promising policy avenue at the moment. However, subsidies to CNG as a fuel and to CNG vehicles can be pursued. The Diesel Pricing and Incentives Study, called for in Task 7.3 of the CAIP work plan, would describe how to bring incentives for diesel and natural gas vehicles in line with the social costs of each by investigating the most promising direct and indirect subsidies for CNG use.</p> <p>Integrating diesel inspection for medium and heavy vehicles into the VET program would complement the CNG component and provide some pollution reduction until more CNG vehicles are bought for transit vehicles. Since buses are kept on the road for many years, and rebuilt several times, overlooking diesel particulate control in favor of CNG substitution will not yield the greatest public health benefits or environmental impact reduction.</p>	<p>Economic incentives which are simple to administer, target only CNG use, and do not impose regressive social costs should be prioritized. The following might fit these criteria:</p> <ul style="list-style-type: none"> <li>• Tax exemptions for firms in the business of CNG conversion, assembly, or supply.</li> <li>• Customs exemptions for CNG transit equipment and supplies</li> <li>• Lower licensing fees or provide fee exemptions for CNG-powered vehicles.</li> <li>• Expand and modify loan programs like Social Fund program to make conversion of diesel vehicles attractive. For example, new CNG minibus purchased by the private sector could be subsidized or made more accessible by inclusion in such programs as the Commodity Import Program.</li> </ul> <p>Other options which would provide sustainable pay-offs in encouraging CNG use and reducing particulate emissions:</p> <ul style="list-style-type: none"> <li>• Local manufacturing/assembly support. Work to reduce constraints on local assembly and manufacture of CNG components. Given the numbers of taxis and perhaps minibuses which would be converted, supporting local capacity for these smaller vehicles rather than transit buses might use CAIP resources more effectively.</li> <li>• Work with microbus and mini-bus companies for either diesel tune-up or CNG use. CNG vans can be imported from the U.S. and are durable and inexpensive. Options could also be explored for Egyptian assembly with U.S. components or to build Egyptian chassis locally for minibuses.</li> </ul>

### **III.**

## **Lead Pollution Abatement (LPA)**

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### **N. Introduction**

Secondary lead smelting in Egypt is primarily the recycling of used lead-acid batteries from industry or automobiles. Approximately 98 percent of all lead-acid batteries in Egypt are recycled at secondary lead smelters, most of which are in the Greater Cairo area. The Lead Pollution Abatement (LPA) component's report, "Recommendations on Assuring Secondary Lead Smelter Used batteries represent 90 percent of the lead-bearing inputs at a typical smelter

The EEAA Lead Smelter Action Plan, adopted in February 1997, lays out the GOE's priorities in dealing with the grave public health risks posed by the operation of secondary lead smelters in the Cairo urban area. However, implementation of the Action Plan has been limited by several overriding factors.

EEAA can only impose sanctions on the smelters in cooperation with the "competent administrative agency," which, in the case of private sector lead smelters, is the respective governorates and for the public sector smelter, the Ministry of Public Enterprises. EEAA does not yet periodically and credibly inspect smelters for violations. The Environmental Monitoring Units with the governorates are understaffed, lack specialized skills, and basic equipment.

Setting up inspections and reporting for the smelters is an opportunity to clarify in practice the responsibilities of the Governorate Environmental Monitoring Units and the EEAA. A critical policy issue that CAIP should pursue is whether smelters will receive special monitoring efforts, and how this responsibility will be divided between EEAA and the governorates. TA recommends ensuring the basic functions of environmental monitoring and compliance enforcement can be performed for the relocated lead smelters by the end of the project. As the project is assisting a few large smelters to relocate, this task could act as a catalyst for capacity building tasks in the future. Since



this monitoring and compliance will be ongoing, achieving these should be included in the LPA component objectives, intermediate objectives, and performance milestones.

Public awareness of the dangers of lead exposure has been increasing rapidly.

Governorate authorities are alarmed by the prospect lead smelters being relocated to their areas, as are local councils. Because of that, relocation plans must be accompanied by effective and targeted public relations campaigns to inform the relevant parties of the realistically assessed hazards. Without the EEAA or governorate monitoring functions described above, citizens, local administrations, and smelter owners will remain mutually suspicious that contractual obligations are not being met.

## **O. Upgrade and Relocate Large Lead Smelters**

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CAIP's mandate is to provide technical assistance in the relocation and upgrade of the two largest smelters in Egypt—Awadallah (private sector) and General Metals (public sector.). Although USAID will not fund equipment procurement or relocation costs, CAIP is to assist with design specifications, tender and procurement documents, financing options, and relocation negotiations.

Qalioubiya Governorate and the Awadallah family signed an agreement on 20 April 1999 to move their three smelters, currently located in Shoubra el-Kheima, to an industrial area in Abu Zaabal, also in Qalioubiya Governorate. The Awadallah smelting operations are profitable, the family applied for a permit to open a new smelter in the past few years, and relocation costs for the three Shoubra smelters will be financed privately.

Based on CAIP's recommendations a list of terms and conditions for the operation of the new smelters according to Law No. 4 was included in the contract. In addition to requiring modern technology to meet environmental legal requirements, conditions included: adhering to the environmental impact assessment (EIA) specifications, allowing inspections, assessing and monitoring performance; disposing of slag in designated landfills, treating liquid wastes, and remediating old sites.

Awadallah's new smelter, in 10<sup>th</sup> of Ramadan, recently added an imported baghouse that has significantly reduced pollution loads. The smelter was closed for a time last year by the authorities for environmental pollution. The remaining Awadallah Cairo smelter, closed by the governorate, is not included in the contract.

General Metals has not secured funding for upgrading technology or for relocation, so CAIP has no current activities related to that smelter. The company is operating at a loss and at about 50 percent of capacity, due to a ban on importing used batteries. The company submitted a proposal to the World Bank Egyptian Pollution Abatement Project to finance a new smelter that included significantly increased capacity to be built at the existing site. The World Bank questioned increasing capacity at General Metals when importing batteries is currently banned under Egyptian law. The Bank has not yet granted

the funding request, pending General Metals' response to its concerns. There were no imminent plans to privatize General Metals as of May 1999 according to the holding company, the Metallurgical Industries Company. General Metals also produces zinc products, aluminum alloys and products, and evaporators, according to Metallurgical Industries Company brochures.

## Recommendations

Significant progress has been made with relocating and upgrading the Awadallah smelters with the signing of the relocation contract. Issues related to the new smelter design, the EIA, industrial landfill usage, and EEAA monitoring are addressed below. Additional points are included below.

### Awadallah Smelters

- ♦ The environmental standards to be met by the new smelter should also be required of the 10<sup>th</sup> of Ramadan smelter and any other smelter owned by the Awadallah family.
- ♦ Awadallah's ownership structure can be generalized to the private sector smelting industry as a whole, which in Egypt is family-based. The families involved often own multiple smelters, some of which may be unlicensed. Assistance to family owners should include all smelters held by the family. The Awadallah relocations and upgrades are just the beginning of a series of lead smelter negotiations with at least four other families, although the Awadallah holdings are undisputedly the largest. As CAIP turns its attention to the owners of small- and medium-sized smelters—some licensed and others unlicensed—all holdings of a single family should be addressed.
- ♦ Awadallah should plan for the remediation of the closed Cairo smelter now. Although the new contract calls for the GOE to draw up a remediation schedule for the Shoubra el-Kheima site once the new smelter is in operation, it is not clear why the government should assume this responsibility.

### General Metals

CAIP has no activities related to the General Metals site remediation at this time. Since CAIP's contract requires the LPA component to assist General Metals to undertake such remediation, the LPA working group should clarify CAIP's role regarding General Metals. TA recommends combining upgrading with assistance on a privatization package to ensure sustainability. The working group should take the following actions to clarify the situation:

- ♦ Ascertain why General Metals is not slated for privatization. Privatizing the facility should be a criterion for financing modernization and upgrades and receipt of CAIP and other USAID technical assistance. Several profitable companies in the Metallurgical Holding Company portfolio have recently been offered for partial

sale in the stock market, including the Ameriyah and Assiut Cement Companies. Current poor financial performance of General Metals is not sufficient reason alone, as modernizing production could lead to greatly increased efficiency according to CAIP financial feasibility studies. Primary counterpart for clarification is the Public Enterprise Office and Dr. Atef Abeid.

- ♦ If no progress is made on privatization, then the CAIP scope should be modified to exclude planning remediation of the General Metals site, which cannot be completed if present trends continue.

## Process Design for Awadallah Lead Smelter

CAIP drew up specifications for new smelter operations, but Awadallah requested modifications. The original specifications called for a blast furnace, as used in US smelters, but Awadallah has requested the use of a locally-manufactured rotary furnace.

## Recommendations

- ♦ Revised design elements should meet environmental standards similar to the original design. Although the present Awadallah contract commits the owner to meet Law No. 4 standards, standards for lead concentration in exhaust gases are less stringent than those required by the USEPA by a factor of 10.
- ♦ Several issues that are not addressed in smelter redesign are a critical part of addressing hazardous materials in the lead industry. The most crucial of these is the draining of electrolyte solution from batteries before they reach the smelters ('dry battery' processes.) The battery supply network to the smelters is both diffuse and informal. Therefore, TA recommends investigating:
  1. How suppliers to Awadallah dispose of the electrolyte solution?
  2. What are the possibilities for recycling the electrolyte solution?
  3. Could suppliers be required to provide records of battery draining procedures or have batteries delivered to Awadallah intact for supervised drainage?
  4. What is the cost of wet battery production processes, where batteries are delivered to the smelter undrained? Would this increase Awadallah's costs? (At present the CAIP approach does not address this issue. USAID or other donors could cover the differential in upgrade costs.)

## Environmental Impact Assessment for New Awadallah Smelter Site

An EIA for both Awadallah's smelter and for the entire industrial site will be required. The site-wide EIA will be arranged and paid for by CAIP. Awadallah will arrange and pay for his new smelter's EIA, and the LPA component will assist him with follow-up to ensure timely approval.

## Recommendations

- ♦ The site-wide EIA should indicate how many smelters and what kind of smelters would be acceptable in one location. The new site near an abandoned basalt quarry has at least 63 households nearby. As the allocated land has space not only for Awadallah but also for other smelters, the cumulative impact of the relocated smelters must first be credibly researched.
- ♦ Carefully plan public outreach with the EIA results. Earlier experience with cancellation of the Sharkiya site, when the governorate refused to accept the smelter's move to the designated site following public and media outcries highlights the need for effective public outreach.
- ♦ CAIP should not focus solely on the preparation of the site-wide environmental impact assessment, but also on EEAA's capacity to review the EIA. This capacity has been a focus of the Danish Government's Support Program for EEAA. The LPA working group and the EEAA EIA section should focus on two issues:
  1. Is the EEAA review substantive and does it provide clear guidelines for smelter owners?
  2. Are provisions made for following up on whether required changes in project design are completed by the smelter owners?

## Lead Smelter Compliance

CAIP held a series of training workshops for environment officials from the Greater Cairo governorates covering the requirements of Law No. 4, information about new and less polluting technologies for lead smelting, and procedures for inspecting lead smelters.

## Recommendations

These workshops addressed a core capacity building need, and should be continued and adapted to the further needs of the governorate inspection units. Training at the governorate level is particularly important because local administrations have been the focal point of conflict between communities and smelter owners, and are authorized to shut down hazardous industries under public health regulations.

Many of the environmental monitoring functions required by the relocation of smelters cannot wait for a full national lead policy to be developed. Because EEAA has resisted prior CAIP attempts to draft elements of such a policy, such as a lead supply and demand study, TA recommends concentrating on those tasks critical to monitoring activities. Monitoring the relocated lead smelters could serve as the nucleus for larger regulatory efforts in industrial compliance, which are currently stalled.

- ♦ TA recommends forming a LPA working group. The existing EEAA Lead Committee could become the core of this group, but membership should include CAIP's LPA component staff.

- ♦ The Lead working group should obtain a MOU that clarifies who will be responsible for monitoring relocated lead smelters. This requires formal commitment from the Governors of Qalioubiya (for the Abu Zaabal site) and Cairo (Katimiyya site), and the Minister of Environment. Training for the relevant individuals can then be planned and timetables for various activities detailed.

## Qalioubiya Solid Waste Landfill

The Greater Cairo Area still does not have designated industrial or mixed-use landfills, although the Prime Minister met with the concerned Governors last year and instructed them to act on this. In the meantime, the LPA component recommends upgrading an abandoned quarry in the Abu Zaabal area for the disposal of smelter slag and for use as a general residential–industrial landfill.

## Recommendations

- ♦ The EIA done for the Sharkiya site called for pretreatment of smelter slag by solidification before disposal. Following this, CAIP sent several slag samples to the US for analysis. Using EPA Toxicity Characteristics Leaching Procedure Guidelines, six samples of slag from three of Awadallah’s smelters were deemed not hazardous because they contained very low levels of lead and the area for the landfill had little rainfall.

However, several additional factors should be considered about slag disposal. At present, slag from different smelters and from different operations varies in the amount of lead it carries. If multiple smelters will use a landfill, each smelter’s slag should be tested. In addition, underground water leaching is a far more important concern than rainfall levels in Egypt. Water tables are high in many parts of the country. Finally, landfills in Egypt are commonly open to workers, nearby residents, livestock, scavengers, and so on. To safeguard the health of people and livestock, it may be necessary to pre-treat the slag or to ensure that the landfill is secure.

- ♦ Abu Zaabal is an industrial area with significant pollution problems, particularly from a public sector fertilizer company. Both the EIA process and the landfill upgrade should be highly publicized to surrounding industries and communities as new models for environmental improvement. This would help to show the governorate and Abu Zaabal communities that EEAA and USAID are not just interested in relocating polluting industries outside Cairo, but are also trying to assist the affected communities.
- ♦ Public awareness campaigns aimed at other industries in the surrounding areas about the availability and rules of the mixed-use landfill could be pursued. Industries depositing wastes should keep records of the kinds of materials

deposited. List of industries supplying these records to EEAA could be published in Al-Ahram and other newspapers.

- ♦ Awadallah will have an EIA and certification of compliance with Law No. 4. If EEAA certifies compliance efforts through Compliance Action Plans (CAP) or other means, this should exert pressure on other nearby industries to bring themselves into compliance.

## **P. Upgrading and Relocating Small and Medium Smelters**

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### **Identify Licensed and Unlicensed Small and Medium Smelters and Provide Assistance in Upgrading Technology and Relocating**

CAIP staff conducted a survey of lead smelters in Egypt and are compiling smelter distribution locations. A study done in 1996 by the EEAA's Technical Cooperation Office for the Environment (TCOE) reported 12 private smelters in Greater Cairo, but did not include unlicensed smelters. The new survey will provide a more accurate assessment of the number of smelters. This work will be continued and expanded to other lead-using metal foundries through the Air Quality Monitoring component's Lead Emission Inventory. Once this survey is complete, the decision to relocate or close smelters can be made.

CAIP has been working on technology options to upgrade the smelting process for small and medium smelters by pursuing the design and local production of a baghouse. Most baghouses are currently imported. The LPA component finalized a capital cost estimate for a minimum-sized smelter to accommodate required pollution control equipment. The assumption underlying CAIP's work in this area is that imported baghouses are too expensive for small- and medium-sized smelters. However, is it not yet clear whether a locally-manufactured baghouse will be affordable for these smelter owners.

### **Recommendations**

The initial CAIP financial feasibility study for small and medium smelters found that an improved process design was financially feasible, since gains in process efficiency resulted in reduced input costs. The feasibility study did not include some of the factors that make small and medium smelters viable, and excluded some that could make relocation more attractive. Cost factors are proximity to labor, feedstock (used batteries), product users (battery manufacturing plants), and utilities. Potentially attractive factors in favor of relocation that should be included in the feasibility study include the high re-use value of urban land and the ability to smelt without intermittent closure by concerned authorities.

Many government relocation plans for small and medium enterprises—potters, foundries, and tanneries—have been unrealistic because they did not consider these proximity and infrastructure factors. A 1986 decree from the Governor of Cairo ordering

Cairo smelters to move to Katimiyya was never implemented. Many smelters operating in central Cairo are periodically closed by administrative order after local protest. Proposed relocation sites in the past have often been without utilities and supporting infrastructure. In contrast, the GOE is responsible for providing utilities at the new Qalioubiya site.

The viability of small and medium lead smelters may depend on the additional capacity added by the large lead smelters. The trend in other countries has been consolidation in larger smelters and a more concentrated industrial structure.

Other recommendations include:

- ♦ Strengthening the ability of governorate and EEAA staff to pursue systematic oversight is needed. Smelter owners and the public both require credible enforcement. Ongoing training of governorate-level staff is a good beginning, as is requiring reporting from the smelter operator.
- ♦ A formal MOU between EEAA and the governorates on the process for smelter closure and subsequent relocation. The MOU should include information for the smelter owners about what criteria they will need to meet in order to relocate their operations (technology upgrades, EIAs, etc.)
- ♦ Consider formalizing the used battery market to reduce incentives for informal smelter operations. Batteries could be turned into authorized lead smelters through a buy-back or deposit scheme greater than the current purchase price offered.
- ♦ The cumulative impact of clustering relocated smelters in new industrial areas on the surrounding communities must be considered. Relocation should not recreate the situation now existing in Shoubra el-Kheima. This should be a consideration in doing site-wide EIAs.

If relocation as well as process upgrades are necessary, and the economic supply and demand study indicates sufficient capacity, then the LPA working group should help smelter owners find funding for these activities. Cost and lack of information are probably the two biggest hindrances to smelter upgrades; therefore, providing information on upgrade options alone is insufficient.

Funding mechanisms can be accessed or established in a variety of ways. The Alexandria Businessmen's Association runs a successful loan program for small and medium enterprises with an almost perfect repayment record that could serve as a model for future credit programs. The Social Fund for Development also has such programs. Egypt Environmental Initiatives Fund (EEIF), a new CIDA project, is a grant and loan fund specifically for small and medium enterprises so that they can comply with the requirements of Law No. 4.

## Compliance Action Plans

Since CAPs are not currently approved or rejected by EEAA, TA recommends LPA drop this task. Preparing CAPs for each small- and medium-sized smelter is probably not

the most efficient use of CAIP resources. The steps outlined above will present the smelter owners with options and means for upgrading and relocation.

## Q. National Lead Policy

An LPA working group with clear responsibilities and accountable deadlines should begin work on this.

### Recommendations

- ♦ The EEAA Lead Committee should work to establish clear responsibility for different sections of the Lead Smelter Action Plan (LSAP). Clarifying accountability for tasks and develop a timetable for implementation. CAIP can participate in some of these activities, as outlined above.
- ♦ Prioritize tasks (as shown in the following table) deemed critical to EEAA or governorate compliance activities for relocated lead smelters. Proposed tasks are slightly modified to incorporate building compliance assurance capacity for lead smelters within EEAA and/or the governorates.

Tasks for Developing a National Lead Policy	Recommended Re-orientation with Reference to Relocations and Upgrades for Smelters
Establish national lead policy	Prioritize EEAA and governorate tasks critical to compliance activities for relocated/upgraded smelters. Prioritize lead smelters for EEAA monitoring, as a catalyst for revitalizing the Industrial Compliance Unit of EEAA.
Review of legislation and regulations, and suggest modifications as needed, particularly regarding: <ul style="list-style-type: none"> <li>- Reporting requirements</li> <li>- Registration and permitting</li> <li>- Emission standards and strong sanctions for non-compliance</li> <li>- Occupational exposures</li> <li>- Used battery disposal and collection</li> <li>- Waste disposal and site remediation.</li> </ul>	All these are currently addressed in some fashion in Law No. 4. Although the regulatory standards may not be ideal, the LPA working group should instead prioritize which existing requirements need to be implemented to ensure that the newly relocated/upgraded smelters can be credibly monitored by EEAA and/or the governorates.
Lead supply and demand analysis	Complete this study as soon as possible. Focus on market determinants rather than absolute figures.



Tasks for Developing a National Lead Policy	Recommended Re-orientation with Reference to Relocations and Upgrades for Smelters
Develop national policy framework for remediation decisions by reviewing existing legislation and proposing modifications.	Use Awadallah and General Metals remediations as pilot project for developing lead smelter remediation framework. From implementing these remediations, lessons can be drawn for further remediation work. As it is quite likely that each remediation will have unique aspects, a national framework may have limited utility .
Support review of air quality standards and recommend changes in law.	Existing air quality standards are not enforced. Ambient air standards are not unduly strict. Instead: <ul style="list-style-type: none"> <li>♦ Develop schedule of penalties for exceeding ambient standards near relocated smelters.</li> <li>♦ Put in place mechanism for applying penalties when limits are exceeded. Ideally, these should be simply activated, perhaps through an ‘environmental deposit’ that owners make available at a third party bank in case of environmental sanctions.</li> </ul>

## R. Propose Interventions to Reduce Demand for Lead Products

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As the Cairo vehicle fleet expands and the construction market booms, the overall demand for lead products will increase. Estimated additional demand is 3,250 tons per year over the next 10 years, resulting from an estimated current demand for lead from 53–60,000 tons per year in 1996 to 85,000 tons in 2005, according to TCOE figures. A TCOE report, *Lead Smelting in Egypt*, suggests the following measures to reduce demand for lead products:

- ♦ Encourage substitution of PVC pipe for lead pipe in the construction industry. As of 1996, an estimated 15–20,000 tons of lead pipe were used in the building trades every year, primarily as drainpipes. Substitution of PVC products would reduce lead use. Although PVC pipes are cheaper, contractors may resist their substitution. The reasons for this should be investigated.
- ♦ Lengthen battery life to reduce the number of batteries needed and the amount of lead handled as a result. Battery life in Egypt seldom exceeds 2 years, whereas in India they last from 3–4 years and in the US, 4–5 years. An assessment of whether this is due to production quality or maintenance habits would be useful. The Cairo vehicle fleet is expected to increase rapidly in the next decade—by about 10 percent initially. Increasing the length of battery life would reduce the amount of lead being smelted annually.

In addition, the lead emission inventory currently being conducted by the Air Quality Monitoring component, should be used to identify new sources of lead pollution and devise action plan for reducing lead in foundries.

## LEAD COMPONENT

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>I. LSAP Objective 1: Upgrade and Relocate Large Lead Smelters</b>		
<b>1.1 Relocation of Large Lead Smelters</b>		
CAIP is to provide technical assistance in the relocation and upgrade of the Awadallah smelters and General Metals. Although USAID will not fund equipment procurement or relocation costs, CAIP is to assist with design specifications, tender and procurement documents, financing options, and relocation negotiations.	<ul style="list-style-type: none"> <li>Most smelter operations in Egypt are family-based, as with Awadallah. Some families own multiple smelters, and among small and medium size operators, some smelters are unlicensed.</li> <li>No action has been taken on General Metals as refinancing/upgrade plan stalled by World Bank over proposed capacity expansions.</li> </ul>	<ul style="list-style-type: none"> <li>CAIP assistance to family owners should be predicated on addressing all smelters owned by a single family. Unlicensed smelters of families assisted should be required to be relocated or closed. This requires EEAA and/or the Governorates to undertake monitoring functions, as described in Task 1.4.</li> <li>USAID should clarify why General Metals is not up for privatization or liquidation. If no movement seems possible on this issue, CAIP's contractual obligation for assistance with the remediation plan should be changed to reflect this situation.</li> </ul>
<b>1.2 Finalize Process Design of Awadallah Lead Smelter</b>		
CAIP's designed specifications for the relocated Awadallah lead smelter. Awadallah has requested that the specifications be revised.	Draining batteries of the electrolyte solution is not included in smelter's redesign, as batteries reach smelter 'dry'. Discarded electrolyte solution is a hazardous material.	<p>How do suppliers of Awadallah dispose of electrolyte solution?</p> <p>Could batteries be supplied 'wet' to Awadallah and the solution recycled?</p> <p>Would a buy-back/deposit scheme on wet batteries induce formalization of battery supply market?</p>
<b>1.3 Prepare Site-Wide EIA</b>		
Awadallah will finance the EIA for his facility and CAIP is expected to help prepare the EIA for the entire relocation site. Public awareness of the dangers of lead exposure has been increasing rapidly. Governorate authorities are increasingly alarmed by the prospect of relocation of lead smelters, as are local councils. Thus, any relocation plans must be accompanied by effective and	<ul style="list-style-type: none"> <li>Does EEAA have adequate review of EIA's for projects dealing with hazardous materials?</li> <li>The Abu Zaabel relocation site near has informal residential area nearby. As the allocated land has space not only for Awadallah but other smelters, the cumulative impact of the relocated smelters must credibly researched.</li> </ul>	<ul style="list-style-type: none"> <li>CAIP can offer assistance to EEAA staff for EIA review if needed. Assistance should cover whether the EEAA review is substantive, provides clear guidance for compliance from smelters owners, and sets out clear for follow-up procedures. This task dovetails with Task 1.4.</li> <li>Emphasize public outreach for the EIA results and ensure EIA is credibly researched. Publicize that</li> </ul>

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
targeted public relations campaigns to inform the relevant parties of the realistically assessed hazards.	<ul style="list-style-type: none"> <li>The cancelled Sharqiya land allocation, where the governorate refused the smelter transfer on the grounds of 'not in my backyard', highlights the need for public outreach.</li> </ul>	Awadallah is the first industry in Abu Zaabel to have conducted an EIA, and that other industries should follow suit for future expansions and upgrades. Meetings with the Local Council and Governorate Councils should be arranged. Households near the relocation area should be informed of the smelter's activities.

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>1.4 Strengthen EEAA and Governorate Capacity to Monitor Law 4 Compliance</b>		
<p>This task is not explicitly included in CAIP's scope of work. However, the environmental monitoring functions needed for successful relocation of the smelters should not be overlooked.</p>	<ul style="list-style-type: none"> <li>• EEAA does not yet periodically and credibly inspect smelters for violations.</li> <li>• EEAA can only impose sanctions on the smelters in co-operation with the "competent administrative agency", which in the case of the lead smelters is the respective Governorates.</li> </ul>	<ul style="list-style-type: none"> <li>• The EEAA Lead Committee should work to establish clear responsibility for different sections of the Lead Smelter Action Plan. Clarifying who "owns" which tasks and drawing up timetables for implementation should help push implementation.</li> <li>• Monitoring the smelters is an opportunity to clarify the responsibilities of the Governorate Environmental Monitoring Units and the EEAA. CAIP should pursue whether smelters will receive special monitoring efforts, and how this responsibility will be divided among EEAA and the Governorates via a formal Memorandum of Understanding.</li> <li>• The basic functions of environmental monitoring and compliance should be performed for the relocated lead smelters by the end of the CAIP project. Since these monitoring and compliance activities will be ongoing, achieving these functions should be included in the Lead Component Objectives, intermediate objectives, and performance milestones. See recommendations under LSAP Objective 3.</li> </ul>
<b>1.5 Upgrade Qalubiyia Industrial Solid Waste Landfill</b>		
<p>The Greater Cairo area still does not have designated industrial or mixed-use landfills. The Lead Component has proposed upgrading an abandoned quarry in the Abu Zaabel area for the disposal of smelter slag and for use as a general residential/industrial landfill.</p>	<ul style="list-style-type: none"> <li>• Abu Zaabel is an industrial area with significant pollution problems. Any upgrade and use of a landfill is an improvement over current practice.</li> <li>• Determination of whether slag needs pre-treatment (solidification) before disposal needs to be decided. The EIA done for the Sharqiya site recommended pre-treatment, while a more recent CAIP review held that the slag was not hazardous.</li> </ul>	<ul style="list-style-type: none"> <li>• Both the EIA process and the landfill upgrade should be highly publicized to surrounding industries and communities as new models for environmental improvement. Awareness campaigns to other industries in the surrounding areas of the landfill could be considered. Industries depositing wastes should keep records of the kinds of industrial materials deposited. List of industries supplying these records to EEAA could be published in Al-Ahram and other newspapers.</li> <li>• Future determinations should include proximity to underground water table, not just rainfall figures, and accessibility of landfill to inhabitants and livestock.</li> </ul>

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>II. LSAP Objective 2: Supporting the Upgrade and Relocation of Small and Medium Smelters</b>		
<b>2.1 &amp; 2.2 Identification and upgrading of small and medium smelters</b>		
<p>CAIP staff conducted a survey of lead smelters in Egypt and are compiling the results of smelter distribution in the Greater Cairo area. The 1996 TCOE study found 12 private smelters in Greater Cairo owned by several families, but did not include unlicensed smelters.</p> <p>CAIP has been working on upgrade options for small and medium smelters by recommending the design and production of a locally-manufactured baghouse. Most baghouses currently available are imported. The Lead Component finalized a capital cost estimate for a minimum size smelter to accommodate required pollution control equipment.</p>	<ul style="list-style-type: none"> <li>• Many small and medium lead smelters are unlicensed and informal, making it difficult to find and track their activities.</li> <li>• Is it viable for small and medium smelters to relocate and/or upgrade? Cost factors include proximity to labor, feedstock (used batteries), product users (battery manufacturing plants) and utilities. Many government relocation plans for small and medium enterprises not worked.</li> <li>• Does the government have the ability to close, relocate, or follow up on informal smelters? If not, then persuading smelters to relocate or upgrade will be difficult.</li> </ul>	<ul style="list-style-type: none"> <li>• The viability of small and medium lead smelters may depend on the additional capacity added by the large lead smelters. The trend in other countries has been consolidation to larger smelters and thus a more concentrated industrial structure.</li> <li>• As recommended in Task 1.4, strengthening Governorate and EEAA ability to pursue systematic oversight is needed. Formalization of the battery input market is another approach to addressing informal lead smelters. Batteries could be turned into authorized lead smelters through a buy-back or deposit scheme which paid more than the current purchase price offered for used batteries.</li> <li>• Leverage financing. If relocation and upgrading are feasible, funds can be leveraged through loan programs to small and medium enterprises. Possible sources include the Egypt Environmental Initiatives Fund (EEIF), a new CIDA project, a grant and loan fund specifically for small and medium enterprises to comply with requirements of Law #4; the Social Fund for Development; and various loan programs run by business associations.</li> </ul>
<b>Task 2.3 Help Prepare Compliance Action Plans</b>		
<p>CAIP is to help prepare compliance action plans for small and medium smelters.</p>	<p>EEAA and GOE do not currently approve or deny compliance action plans as EEAA's authority on this issue is questioned.</p>	<p>Transition Assurance recommends dropping this task. Preparing CAP's for each small and medium-size smelter is probably not the most efficient use of CAIP resources as CAP's are not currently being used. Task 2.1 and 2.2 will attempt to present the smelter owners with options and means for upgrading and relocation, and preparing a CAP does not contribute to this decision-making process at present.</p>

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>Tasks 2.4 &amp; 2.5 Provide EIA for Relocating Small and Medium Smelters and Upgrading of Solid Waste Landfill</b>		
		Same recommendations as for Task 1.3 and Task 1.5.
<b>LSAP Objective #3 Design National Lead Policy</b>		
<b>3.1 Establish national lead policy</b>		
Tasks described under LSAP Objective 3	Draft CAIP workplans contained the following tasks. We recommend these be reoriented to focus on the specific needs of lead smelter upgrade and relocation activities, as little progress has been made on developing a national lead action plan.	Recommended re-orientations with reference to relocations/upgrades of lead smelters
Review of Legislation and Regulations, and suggesting modifications as needed, particularly regarding: <ol style="list-style-type: none"> <li>1. Reporting requirements</li> <li>2. Registration and permitting</li> <li>3. Emission standards and strong sanctions for non-compliance</li> <li>4. Occupational exposures</li> <li>5. Used battery disposal and collection</li> </ol> Waste disposal and site remediation.	All these are currently addressed in some fashion in Law #4.	Although the regulatory standards may not be ideal, the Lead Working Group should instead prioritize which existing requirements need to be implemented to ensure that the newly relocated/upgraded smelters can be credibly monitored by EEAA and/or the Governorates.
Lead supply and demand analysis.	Initial CAIP scope of work on this was questioned by EEAA. Some effort needs to be made to clarify to EEAA why this study is important.	Before further work on small and medium smelters is done, it would be helpful to have an overall picture of the market. Complete draft as soon as possible. We recommend focusing on market determinants rather than absolute figures which are most likely inaccurate, so that the study can be updated as needed.
Develop national policy framework for remediation decisions by reviewing existing legislation and proposing modifications.	Remediation of Awadallah smelter and other relocated large smelters should not wait for completion of such an overview. As it is quite likely that each remediation will have unique aspects, a national framework may have limited utility.	Both Awadallah and General Metals remediations can proceed with liability for subcontracting remediations placed on the respective companies. Financing may be available from KfW and the World Bank through the EPAP Project at EEAA. Awadallah and General Metals remediations can serve as pilot projects for developing lead smelter remediation framework if one is desired.
Support review of air quality standards and recommend changes in law.	Existing air quality standards are not enforced. Ambient air standards are not unduly strict.	Focus on discrete tasks necessary for enforcing Law #4 for lead. <ul style="list-style-type: none"> <li>• Develop schedule of penalties for exceeding</li> </ul>

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
		<p>ambient standards near relocated smelters.</p> <ul style="list-style-type: none"> <li>Put in place mechanism for applying penalties when limits exceeded. Ideally, these should be simply activated, perhaps through an 'environmental deposit' which owners make available at a third party bank in case of environmental sanctions.</li> </ul>
<b>3.2 New Initiatives: Reduce demand for lead products</b>		
<p>As the Cairo vehicle fleet expands and the construction market booms, the overall demand for lead products will increase. Estimated additional demand is 3,250 tons per year over the next 10 years, resulting from an estimated current demand for lead from 53-60,000 tons per year in 1996 to 85,000 tons in 2005. (TCOE/EEAA: Lead Smelting in Egypt, 1996.)</p>	<p>The 1996 TCOE report suggests the following measures to reduce demand for lead products:</p> <ul style="list-style-type: none"> <li>Encourage substitution of PVC piping for lead piping in construction projects. The construction industry as of 1996 used an estimated 15,000-20,000 tons per year of lead piping, primarily used for inside dwelling drainage.</li> <li>Lengthen battery life. This will reduce the number of batteries needed to be produced and the amount of lead handled as a result. Battery life in Egypt seldom exceeds two years whereas in India estimates range from 3-4 years and in the U.S., 4-5 years.</li> </ul>	<ul style="list-style-type: none"> <li>Although cheaper and locally produced, PVC pipes have not replaced lead piping. Thus efforts to substitute PVC for lead would have to address why not. Some strategies are to raise awareness among contractors, require contractors to certify PVC use, and/or adopt preferential contracting for contractors providing such certifications.</li> <li>Particularly as the Cairo vehicle fleet is expected to increase rapidly in the next decade, increasing the length of battery life would reduce the amount of lead being smelted annually. The causes of relatively short battery life in Egypt are not clear. A brief assessment of whether this is due to production quality and/or poor maintenance would be useful. Measures to lengthen life and improve quality could then be devised.</li> </ul>



## **IV.**

### **Air Quality Monitoring (AQM)**

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#### **S. Introduction**

The contractual scope of the AQM component is to track lead and particulate emissions in Greater Cairo. The CAIP air monitoring network was established to evaluate the progress of the initiatives begun under the project: upgrading and relocating lead smelters; implementing a vehicle emissions testing program; and the shift from diesel to CNG as a fuel for transit buses.

By October 1999, the network will have provided a year's comprehensive and consistent data for a baseline database of lead and particulate measurements. The AQM component is also preparing to conduct a source attribution study in the summer of 1999 and carry out the first comprehensive lead emission inventory for the Greater Cairo Area. This inventory will estimate lead emissions from secondary lead smelters and a variety of other sources, including aluminum and copper foundries and ceramics producers.

#### **T. Stakeholder Expectations for New Initiatives:**

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EEAA Environmental Quality staff communicated the following priorities to the TA team. Neither of these is currently within the CAIP scope of work or budget allocations. To support these efforts would require a change in the scope and additional funding. These measures are key activities to ensure that air quality data collected by the CAIP and the Environmental Information Management Program's (EIMP) networks could eventually be managed and used by Egyptian policy-makers.

- ♦ Training in quality assurance (QA) and information management support for an Egyptian air quality monitoring network. There is a serious need to ensure the quality of the environmental measurements being performed under CAIP and EIMP's monitoring efforts. CAIP devoted considerable effort to establishing a QA

program in the sampling and analysis processes with measurable indicators of quality. The latter is an important product of a QA program.

Since sampling for both networks is subcontracted to the same contractor (Cairo University's Center for Environmental Hazard Mitigation), transfer and training of CAIP's QA procedures to EEAA staff could be undertaken in cooperation with EIMP. In addition, CAIP's contract with the Egyptian Geological and Mining Services for sample analysis could be adapted and transferred to EEAA if appropriate. Training could be provided in ensuring data integrity, information management, and eventually, the kind of trend analysis and regulatory recommendations sought by EEAA. Some of this technical assistance has been provided through informal sharing of CAIP's database model and cooperation on locating monitoring sites.

- ♦ Support EEAA data analysis and interpretation capacity. Neither EIMP nor CAIP includes support for policy analysis and presentation. At present there is little capacity for planning or developing air quality management strategies within EEAA, but there is a demand for these skills according to EEAA staff.

Policy analysis capabilities for the influx of air monitoring data are a strongly perceived need by EEAA. The Environment Quality Section wants support in setting guidelines on how to interpret air monitoring data, what they term the development of an "information decision and support system" for air quality data. Desired outputs are a pollution control index, reported daily to decision-makers and the media, and the capability to make ongoing assessments of air pollution "hotspots."

It should be noted that this institutional gap in policy analysis and evaluation functions is not confined to air quality issues. Few sections at EEAA presently have this capability, though several are shaping policy decisions through their activities.

CAIP could support this in conjunction with the Air Quality Section of EEAA and EIMP. Such a proposal for a 'decision support system' would need approval of the EEAA Chairman before additional planning takes place.

## U. Monitoring Ambient Particulate Matter and Lead

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### Implementation Status

A 36-station monitoring network was established in Greater Cairo. The network measures lead (Pb) and fine particulates (PM<sub>2.5</sub> and PM<sub>10</sub>) and includes a range of site types, including traffic, residential, and industrial. Sampling is done for a 24-hour period every sixth day. The goal of the first year's sampling was to establish lead and particulate baselines for future reference and to verify locations of lead and particulate 'hot spots.'

Sampling is done under contract with Cairo University's Center for Environmental Hazard Mitigation; gravimetric analysis of the filter samples is done under contract with the Egyptian Geological and Mining Survey Authority (EGSMA). Rigorous QA procedures have been put in place. Data processing and reporting mechanisms for lead/particulate results and meteorological data have been established, and monthly reports are currently being issued.

Proposals and procurement plans were drawn up for a reduced, more durable, replacement network, but these plans have been refused by the EEAA Chairman, who prefers the network operate as it is.

## Recommendations

In terms of measuring project interventions, the existing network can measure the effects of relocating large secondary lead smelters as planned. However, further evaluation of CAIP interventions cannot be done with the network as currently configured since the particulate measurements contain no "tracers" to analyze what kinds of particulate emissions are being emitted and by what sources. In addition, the high natural background rate of particulates in Cairo makes this a poor indicator of successful air quality interventions. AQM staff have indicated that neither CNG use in transit fleets nor the VET program interventions could be monitored by the network as currently configured, particularly as neither intervention can produce a substantial reduction in particulates in the short-term.

Therefore, TA suggests considering the following in deciding the function of the existing network and its procurement needs. The AQM working group can jointly decide what purpose the CAIP network is to serve in the future.

The following are recommended:

- ♦ Seek the EEAA Chairman's approval to transition the CAIP PM and Pb monitoring program management to EEAA by the end of 1999. CAIP will train an EEAA staff member and provide technical support following the transition.
- ♦ Before transition, clarify with Chairman what is the purpose of the EEAA/CAIP network.
  - Maintain Pb and PM monitoring activities. If the network's purpose is to monitor lead and particulates, then TA recommends that the number of sites be reduced from 36 to 15 after the baseline year data is collected, and the short-life, manually operated AIRmetrics samplers be replaced with more durable, automated systems. Routine PM<sub>2.5</sub> monitoring should be discontinued since the baseline data shows consistent PM<sub>2.5</sub>/PM<sub>10</sub> mass, and since Egypt has enough to be concerned about with the very high total suspended particulates (TSP) and PM<sub>10</sub> levels. A proposal to this effect was approved by USAID, CAIP, and EIMP, but refused by the EEAA Chairman. This issue should be reopened if the network is to be continued.

- Expand monitoring capabilities to volatile organic compounds (VOC) and suspended volatile organic compounds (SVOC). TA recommends considering changing the objective of the network to perform ambient measurements of VOCs, SVOCs, and perhaps, trace elements by XRF analysis. Most of the equipment required has been donated by the Japanese Inter-Cooperation Agency (JICA) and is already available in the EEAA Central Laboratory. Additional appropriate monitoring equipment could be provided by the upcoming source attribution study. A training program would necessary to prepare personnel to perform these more sophisticated sampling and analysis procedures. Enhanced monitoring sites may not be the same ones already included in the EIMP or CAIP project. For example, VOC monitoring might be desired near petroleum refineries or petrochemical plants producing toxic materials.

An enhanced network with these monitoring capabilities would have the following advantages:

1. Measurement of VOCs and SVOCs

CAIP activities were agreed upon by USAID and the GOE on the premise that the two greatest health threats from air pollution in the Cairo area were fine particulates and lead. Fine particulates generated by anthropogenic sources, particularly vehicle emissions and incomplete combustions from open burnings, however, are more hazardous to human health than naturally occurring fine particulates because they contain mutagenic and carcinogenic compounds.

Monitoring volatile and semi-volatile organic compounds allows vehicle emission and open burning contributions to be tracked over time, both of which are significant contributors to Cairo's dangerous air quality. For example, some carcinogenic combustion products found in diesel exhaust include polycyclic aromatic hydrocarbons (PAH's), which can be detected by monitoring SVOC's. MTBE, currently added as a an anti-knock additive to replace lead compounds, can be detected by monitoring for VOC's. Open burning of trash and industrial wastes, a common practice in Cairo and Egypt as a whole, produces an array of compounds which can be detected only through an expanded monitoring effort.

Ongoing ambient measurement of the most distinctive compounds produced by vehicle exhaust and open burnings would provide a much-needed assessment tool for developing air quality management strategies. These measurements would also provide a comparative tool to evaluate the findings of source apportionment studies.

2. Enhance the Egyptian Air Quality Monitoring Network Capabilities

The existing EIMP network does not measure these compounds, and DANIDA's representative also strongly indicated the need for such measurements. As

DANIDA's funding for EIMP is being phased out (this year EEAA was responsible for 50% of project costs, and next year will be responsible for 75% of the costs before a final phase-out of Danida funding the following year) it is doubtful these enhanced capacities will be added to the EIMP network. The required staff training and equipment procurement would also make it possible for local personnel to conduct future source attribution studies.

### 3. Buttress CAIP interventions in the VET and CNG components.

CAIP's activities in reducing vehicle emissions would be strengthened by rigorous data on the contribution of vehicle emissions to Cairo's poor air quality. If the CAIP network is to monitor vehicle emissions, enhanced monitoring at appropriate individual sites should be introduced and the network must operate for longer than the current projected life of the project. The equipment to be procured for the summer 1999 Source Attribution Study, which by necessity must measure the full range of air pollutants to develop accurate source attribution estimates, could be redeployed in such a redirected monitoring effort.

In summary, enhancing the capability of an Egyptian Air Monitoring Network to measure ambient levels of these species would: 1) measure compounds important in Cairo given the supposed levels of vehicle and open burning emissions; 2) enhance the EAQMN monitoring capability; and 3) allow better evaluation and data to support other components.

## V. Baseline Source Attribution Modeling Study

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The goal of the SAS is to provide a baseline determination of the contribution of various sources-- particularly mobile and lead emission sources-- to ambient pollution levels in Greater Cairo. The SAS should provide valuable guidance as to the relative importance of various pollutants and their likely sources. Unlike the prior SAS carried out in 1994-5, the 1999 Source Attribution Study should better distinguish between contributions from vehicle emissions, particularly diesel, and open burning.

Since the current network monitors only lead and particulates, additional equipment is necessary to be able to accurately characterize emissions sources. This equipment must measure volatile and semi-volatile organic compounds (VOC's and SVOC's), especially polycyclic aromatic hydrocarbons, which act as tracers for diesel emissions. Six sites will be used from among the current network sites. The Desert Research Institute, U.S, is planning the study and analyzing the data; an Egyptian CAIP staff member will visit DRI to participate in the data analysis and modeling work.

The SAS is urgently needed to help prioritize air pollution interventions in Cairo, as well as help estimate the relative impacts of the VET and CNG initiatives. The previous SAS, done in 1994-95, found that the single largest contributor to Cairo air pollution was open

burning of trash, and that vehicle emissions were a relatively small contributor, except for in downtown Cairo where heavy duty diesel emissions were a significant contributor (38%). Recent critiques of this study argue that several source attributions had chemical signatures which closely resembled one another, especially diesel and open burnings. This report suggests that adding new chemical species for measurement which vary in each source should help resolve these collinearities. However, the report makes several inaccurate assumptions about the composition of trash burnings in Cairo, classifying them as vegetative burnings.<sup>1</sup> Conducting source samplings at several actual Cairo burning sites should help clarify whether tracers can be identified that are distinctive from those found in diesel and gas vehicle emissions.

## W. Baseline Lead Emission Inventory

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### Implementation Status

The baseline emission inventory is to provide policymakers with an assessment of the distribution and severity of lead emissions. Conducting an emission inventory is at present complicated by the lack of existing data on lead emissions and sources. Two factors complicate the situation further: the unknown number of informal and unlicensed secondary lead smelters, and the presence of lead in other metallurgical facilities. Limited resources means not all facilities can be source tested; therefore, grouping of similar facilities will be done to allow estimations based on a representative sample. In 1999, two Egyptian staff members were trained in emission inventory techniques as part of a two week US study tour. In 1998, several EEAA, Cairo University, and CAIP staff attended a four-day workshop on Emission Inventory Development.

### Recommendations

Expand project training to fully include EEAA.

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<sup>1</sup> Suggested tracers are soluble potassium, used in the U.S. for vegetative burnings, and methoxylated phenols, used to apportion wood combustion. Open burnings in Cairo and surrounding areas are often not primarily vegetative, let alone wood based. Rather, they are mixtures of industrial and residential trash, and include used tires, solvents, metal barrels, plastics, paper, and organic matter. These informal sites often spontaneously combust in the heat. According to the Danish EIMP director, who has conducted source samples from some of these sites, the resulting emissions carry mixtures of VOC's and SVOC's unlike anything he measured in Europe.

The lead inventory will be the first inventory of a pollutant done in Egypt. In order to adequately devise an air quality management strategy, the EEAA Environment Quality Section will eventually need to conduct inventories of other pollutants. While the CAIP plan includes training of Egyptian CAIP staff, consideration should be given to training EEAA staff in inventory techniques and how to manage the emission inventory database.

Help EEAA Lead Working Committee develop strategy to use information gathered in emission inventory.

CAIP can propose to help devise strategies for lead abatement if the results of the inventory suggest further action. The CAIP Lead Component is already addressing the most significant contributor, the secondary lead smelters.

## AIR QUALITY MONITORING COMPONENT

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>TASK 1 Ambient Monitoring for Particulate Matter and Lead</b>		
<b>1.1 Transition Existing Network to EEAA</b>		
<p><i>A monitoring network of 36 stations was established in Greater Cairo. The goal of the first year sampling was to establish lead and particulate baselines for future reference and to verify location of lead and particulate 'hot spots.' These goals will be complete by October 1999.</i></p> <p><i>The primary counterpart for CAIP's air quality monitoring component is the Environmental Quality Section of EEAA. DANIDA's Environmental Information and Monitoring Programme (EIMP), a network of forty stations, twelve of which are in the Greater Cairo area, is also under this section. Currently, the CAIP monitoring network complements the EAQMN in the greater Cairo area by: 1) providing the only lead monitoring data collected at present; 2) providing accurate PM2.5 monitoring and 3) significantly expanding the PM10 database.</i></p>	<p><i>With the exception of large smelter relocations, further evaluation of CAIP interventions cannot be done with the network as currently configured. Particulate measurements contain no "tracers" to analyze what kinds of particulate emissions are being emitted and by what sources. In addition, the high natural background rate of particulates in Cairo makes this a poor indicator of successful air quality interventions.</i></p> <p><i>Now that a high quality baseline data exists for lead, PM10, and PM2.5, the existing network should reconfigured. Several choices exist:</i></p> <ul style="list-style-type: none"> <li><i>• Reduce number of sites and install durable equipment so that the network could be transitioned to EEAA by the end of 1999.</i></li> <li><i>• Enhance monitoring capability of the network to include VOC's, SVOC's, and trace elements.</i></li> <li><i>• Support enhanced monitoring capacity at EIMP's Cairo sites.</i></li> </ul>	<ol style="list-style-type: none"> <li><i>1. Seek the EEAA Chairman's approval to transition the CAIP PM and lead monitoring program management to EEAA by the end of 1999. CAIP will train an EEAA staff member and provide technical support following the transition.</i></li> <li><i>2. Before transition, clarify with Chairman what is the purpose of the EEAA/CAIP network.</i></li> </ol> <ul style="list-style-type: none"> <li><i>• <u>Maintain Lead/Particulates Monitoring.</u></i></li> </ul> <p><i>If the purpose is to monitor lead and particulates as currently done, than transition assurance recommends that the number of sites be reduced from 36 to 15 after the baseline year data is collected, and the short-life, manually operated samplers be replaced with more durable, automated systems. Routine PM2.5 monitoring should be discontinued since the one year of baseline data shows consistent PM2.5/PM 10 mass ratios.</i></p> <ul style="list-style-type: none"> <li><i>• <u>Expand Monitoring Capabilities to VOC's and SVOC's.</u></i></li> </ul> <p><i>Transition assurance recommends considering changing the objective of the network to perform ambient measurements of VOC's, SVOC's, and perhaps, trace elements by XRF analysis. Most of the equipment required has been donated by JICA and is already available in the EEAA Central Laboratory, and additional appropriate monitoring equipment could be provided through the upcoming Source Attribution Study. A training program would necessary to prepare personnel to perform these more sophisticated sampling and analysis procedures. Enhanced monitoring sites might not be the same ones already included in the EIMP or CAIP project.</i></p>



<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>1.2 New Initiative: Expand Monitoring Capabilities to Include VOC's and SVOC's.</b>		
<i>Monitoring volatile and semi-volatile organic compounds allows vehicle emission and open burning contributions to be tracked over time. Both contribute significantly to Cairo's poor air quality. Some carcinogenic combustion products found in diesel exhaust include polycyclic aromatic hydrocarbons (PAH's), which can be detected by monitoring SVOC's. MTBE, currently added as an anti-knock additive to replace lead compounds, can be detected by monitoring for VOC's.</i>	<i>VOC's and SVOC's are particularly important compounds to measure in the Cairo context. Open burning of trash and industrial wastes, a common practice in Cairo and Egypt as a whole, produces an array of compounds which can be detected only through an expanded monitoring effort. The existing EIMP network does not measure these compounds; DANIDA's representative also strongly indicated the need for such measurements.</i>	<ul style="list-style-type: none"> <li>• <i>Additional monitoring at either EIMP's or CAIP's sites would enhance the Egyptian network capabilities. The required staff training and equipment procurement would make it possible for EEAA to conduct future source attribution studies. At present, this capability is lacking.</i></li> <li>• <i>CAIP's activities in reducing vehicle emissions would be strengthened by rigorous data on the contribution of vehicle emissions to Cairo's poor air quality.</i></li> <li>• <i>Adequate data on the contributions of vehicles and open burnings would be available to devise priority air quality measures.</i></li> </ul>
<b>Task 2 Baseline Source Attribution Study</b>		
<i>The goal of the SAS is to provide a baseline determination of the contribution of various sources—particularly mobile and lead emission sources-- to ambient pollution levels in Greater Cairo. The SAS should provide valuable guidance as to the relative importance of various pollutants and their likely sources. Unlike the prior SAS carried out in 1994-5, the 1999 Source Attribution Study should better distinguish between contributions from vehicle emissions, particularly diesel, and open burning.</i>	<ul style="list-style-type: none"> <li>• <i>Additional equipment is necessary to be able to accurately characterize emissions sources. This equipment must measure volatile and semi-volatile organic compounds (VOC's and SVOC's), especially polycyclic aromatic hydrocarbons, which act as tracers for diesel emissions.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>The equipment to be procured for the summer 1999 Source Attribution Study, which by necessity must measure the full range of air pollutants to develop accurate source attribution estimates, could be redeployed for Task 1.2, expanding the Egyptian Air Monitoring Network to include VOC's and SVOC's.</i></li> <li>• <i>Conduct source samplings at several Cairo burning sites to clarify whether tracers can be identified that are distinctive from those found in diesel and gas vehicle emissions. These tracers may not be the same as found in U.S. "vegetative" burnings.</i></li> </ul>
<b>Task 4 Baseline Lead Emission Inventory</b>		
<i>The baseline emission inventory is to provide policymakers with an assessment of the distribution and severity of lead emissions. The unknown number of informal and unlicensed secondary lead smelters, and the presence of lead in other metallurgical facilities makes conducting the inventory more difficult. Limited resources means not all facilities can be source tested; therefore, grouping of similar facilities will be done to allow estimations based on a representative sample.</i>	<ul style="list-style-type: none"> <li>• <i>The lead inventory will be the first inventory of a pollutant done in Egypt. In order to adequately devise an air quality management strategy, the EEAA Environment Quality Section will eventually need to conduct inventories of other pollutants.</i></li> <li>• <i>The EEAA Lead Committee is seemingly moribund and thus it is unclear what institutional entity exists for using the data gathered for the Emission Inventory.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>While the CAIP plan includes training of Egyptian CAIP staff, consideration should be given to training EEAA staff in inventory techniques and how to manage the emission inventory database. Help EEAA Lead Working Committee develop strategy to use information gathered in emission inventory.</i></li> <li>• <i>The CAIP Lead Component and AQM Component can propose to devise strategies for lead abatement if the results of the inventory suggest further action. The CAIP-EEAA Lead Working Group should pursue monitoring lead smelters and lead-using facilities, even after planned relocations.</i></li> </ul>

<i>CAIP's TASK</i>	<i>Issues and Observations</i>	<i>Transition Assurance Issues/Recommendations</i>
<b>5. Transition Assurance Measures / New Initiatives</b>		
<b>5.1 Training in Quality Assurance and Information Management Support for an Egyptian Air Quality Monitoring Network</b>		
<i>There is a serious need to ensure the quality of the environmental measurements being performed under the CAIP and EIMP's monitoring efforts. CAIP devoted considerable effort in establishing a quality assurance program in the sampling and analysis area with measurable indicators of quality. The latter is an important product of a QA program.</i>	<i>Training could be provided in ensuring data integrity and information management to EEAA. Some of this technical assistance has been provided through informal sharing of CAIP's database and site locations.</i>	<i>Since sampling for both networks is subcontracted out to the same contractor (Cairo University's Center for Environmental Hazard Mitigation), transfer and training of CAIP's quality assurance procedures to EEAA staff could be undertaken in cooperation with EIMP. In addition, CAIP's contract with the Egyptian Geological and Mining Services for sample analysis could be adapted and transferred to EEAA if appropriate.</i>
<b>5.2 Support EEAA data analysis and interpretation capacity</b>		
<i>Policy analysis capabilities for the influx of air monitoring data is a perceived need by EEAA Environmental Quality Staff. EEAA staff want support in setting guidelines on how to interpret air monitoring data, an "information decision and support system" for air quality information. Desired outputs are a pollution control index (reported daily to decision-makers and the media) and the capability to make ongoing assessments of air pollution "hotspots."</i>	<ul style="list-style-type: none"> <li><i>Neither DANIDA's EIMP nor the CAIP includes support for policy analysis and presentation. At present there is little capacity for developing air quality management strategies within EEAA.</i></li> <li><i>Neither 5.1 or 5.2 is currently within the CAIP scope of work or budget allocations.</i></li> </ul>	<ul style="list-style-type: none"> <li><i>CAIP could support this EEAA need in conjunction with the Air Quality Section of EEAA and EIMP. Such a proposal for a 'decision support system' would need approval of the EEAA Chairman before additional planning takes place. EEAA Environmental Quality staff communicated the following priorities to the transition assurance team.</i></li> <li><i>Training and technical assistance could be delivered to EEAA in trend analysis, data interpretation, and regulatory recommendations.</i></li> <li><i>CAIP support of these efforts would require a change in the scope of work and additional funding.</i></li> </ul>